THE IRON TRADE REVIEW

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THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

July has put a very large tonnage on the order books of furnaces and mills, and has done much to determine the position of the market in the first half of 1903. The past week, while not so active in some centers as the preceding one, has revealed a very general interest among buyers of foundry iron in the possibilities for the first and second quarters of next year. This is prompted in part by the embarrassment of some consumers who have needed iron for immediate use and have not been able to get it. Less is heard about the arrears of deliveries of iron to steel works than of the troubles of foundries, but it is already evident that there will be a great shortage on Bessemer and basic iron, particularly the former, contracted for by large works to be delivered this year. Some steel plants are now making smaller outputs than usual because iron cannot be had as needed, and in the Pittsburg District several finishing plants have had to suspend because steel could not be had. The prolongation of shut-downs in July was due to this cause in several instances rather than to urgent necessity of making repairs. The easier feeling in steel predicated on the July shut-downs, was rather anticipative than based on actual sales. Foreign steel has been offered at somewhat lower prices, but domestic billets are still sold at $33 to $34 for the small lots that are practically all the going business. Until pig iron is more plentiful steel makers are not likely to meet the views of buyers who are holding off for considerably lower prices on contract steel. The enormous production of pig iron in the first half of the year—8,808,574 gross tons—with unsold stocks on June 30 reduced to 29,861 tons, against 372,560 tons a year previous, gives some measure of a still growing consumption. And the impression is heightened by the figures for pig iron imports which have now reached 2,000 tons a day. Foundries pressed for iron are taking small lots of Scotch pig iron at $25 to $26 delivered in the Central West, and import iron has gone as far West as the Chicago district. The Southern furnaces have made sales for next year at $17 Birmingham for No. 2, following earlier sales at $16.50 and some are disposed to ask $17.50 and even $18. The Chicago District reports a large business with prices tending upward for both Southern and Northern iron. Structural material shows the strongest situation in the entire market. Heavy selling for next year continues, and deliveries before July 1 are now impossible with some mills. Plates are also strong on steady demand. The starting up of two Pennsylvania mills in October is expected to give some relief, though both have booked considerable advance tonnage. Other plate mill capacity is building, to be ready next year. The sheet market, particularly on galvanized, is weak, and more capacity is coming on with prospects of overproduction, as is also the case in tin plates. The proposal that tin plate workers accept a 25 percent reduction on plates for export to replace drawback plates is undoubtedly defeated, though the result is not yet officially announced. The fuel scarcity still hampers the iron trade, and is at the bottom of the scarcity of pig iron, steel and finished material. It is a question, too, if the fuel supply will expand in the next 12 months to make effective the new capacity in various lines that on its face gives promise of a very considerable increase in production.

PITTSBURG.

OFFICE OF *The Iron Trade Review*, 429 PARK BUILDING, July 30.

That there will be a considerable shortage of both pig iron and steel before the end of the year is growing more apparent daily. Furnaces in the Mahoning and Shenango Valleys and those in the South, supplying this district are by no means catching up on their deliveries; some of them, especially those in the South, get further behind daily. The merchant furnaces in the Valleys that supply this district with a large tonnage of Bessemer are from one to three months behind, while deliveries on foundry iron are in arrears from one to two months. Unless conditions grow more favorable during the next few months enabling the furnaces to produce at least their normal output the shortage will grow more pronounced. And if this proves to be the case both foundries and steel plants will be compelled to shut down at periods during the next five months on account of the failure in the supply of iron. Foundry iron for prompt shipment has been making new high record marks during the week, and many of the consumers that only a short time ago interested themselves in their supply for next year are confronted with conditions not anticipated for the remainder of the year.

While there continues to be considerable talk in some quarters about $31 Bessemer billets, mills with small lots for early shipment, find little difficulty in securing $33.50 to $34 for their product. Many consumers of billets have signified their intentions of closing contracts for the remainder of the year, providing the mills would name a price that would permit them to make a small profit on their finished product, but as long as the steel producers can secure the high prices quoted above, they are not at all anxious to meet the consumer half way. Few if any of the steel mills that place their surplus product on the market are securing all the pig iron they require, and as a result their production of steel is greatly reduced. The large steel producers are also suffering on account of the shortage of pig iron with a resultant curtailment in their output of steel. One of the largest independent mills in this district has had a number of its finishing mills idle during the past two weeks on account of the shortage in its steel production, and rather than pay the high prices asked for both Bessemer and open-hearth steel nearly equal to the selling price of some finished products, the mills will remain idle until the steel producing capacity of the plant can be brought up to its normal level again.

The closing down of many mills for the first half of July failed to relieve the pressure on steel, and it has been hinted that many of these mills closed down more on account of the shortage in the supply of steel than for much needed repairs. In finished lines the market continues firm with better deliveries in view on steel bars that can be rolled on continuous mills.

PIG IRON.—The past week has been comparatively quiet, the buying of iron for delivery the first half of next year having fallen off to some extent. The sales of the week total about 10,000 tons, a large portion of this having been closed with Southern companies, which only last week opened their books for business for next year's delivery. Northern furnaces are now asking $22 for No. 2 foundry for delivery the first half of

next year and several large contracts were closed at this price. The Southern iron was sold on a basis of $21.15, Pittsburg. No. 2 foundry iron for prompt delivery is selling at still higher prices, one lot of 300 tons for delivery within 60 days having brought $24 a ton. Little Bessemer iron is being offered and practically none is being sold. We note the sale of 1,000 tons of Southern basic for delivery the last quarter of the year at $19 at the furnace and several of the Virginia furnaces are offering early shipment foundry iron at $22 per ton delivered, Pittsburg. Little is being sold, however, despite the big concession in price. We revise quotations for 1902 delivery as follows:

Bessemer, Valley	$21 00 to 21 75
Bessemer, Pittsburg	21 75 to 22 50
No. 1 Foundry	24 50 to 25 00
No. 2 Foundry	23 00 to 24 00
No. 3 Foundry	21 75 to 22 25
Gray Forge, Pittsburg	20 75 to 21 25
Chilled Basic, Valley	20 50 to 21 00
Chilled Basic, Pittsburg	21 25 to 21 75

STEEL.—There is little change in the steel situation. Consumers still refuse to place contracts for delivery the remainder of the year, while the steel producers contend that they are selling their entire output for early shipment at prices ranging from $33.50 to $34 per ton for Bessemer and $34.50 for open-hearth at the mill. Even at these prices none of the mills have very large lots to offer. There is little doing in foreign steel, practically none having been sold during the week although it is being freely offered at $31 per ton, with sheet bars at $31.50. Many of the finishing mills that purchased foreign steel earlier in the year, finding the quality of the product not altogether adaptèd to their requirements, are disposing of the lots they have on hand and are buying domestic steel instead. On the other hand a number of consumers declare the foreign steel just suited to their purpose and are picking up all the bargains offered. The largest independent steel producer has a number of finishing mills closed at the present time on account of the scarcity of steel.

SPELTER.—The spelter market continues firm and we quote prime Western grades at 5.15c to 5.20c, Pittsburg.

FERRO-MANGANESE.—The German product, guaranteed 80 per cent, is quoted at $52.25, delivered at buyer's mill and English at $52.50. Domestic is also held nominally at the latter price.

MUCK BAR.—A fair demand continues for neutral muck and several small lots have been sold during the week for early delivery at $36.50 at mill.

SKELP.—There has been little buying of iron skelp during the past few days while steel skelp continues very scarce. The former is quoted at 2.10c to 2.15c for both grooved and sheared, and steel at 2.25c.

RAILS AND TRACK MATERIAL.—The light rail capacity is to be increased by the erection of a number of new mills in the next six to eight months and it is believed that when this increased tonnage is placed on the market prices will be considerably lower. Until this additional capacity is in operation, however, there is little relief in sight. We make the following quotations: Standard sections, 50 pounds and over, in lots of 200 tons and over, $28; car lots and less than 200 tons, $30; less than car lots, $32; light rails, 8 pounds, $46; 12 pounds, $44; 16 pounds, $42; 20 pounds, $40; 25 to 40 pounds, $38 to $40. Track material: Spikes, 2c to 2.05c; track bolts, square heads, 2.50c; hexagon heads, 2.65c; fish plates, 1.60c.

BARS.—The current business in both iron and steel bars is entirely satisfactory, and all the mills have from four to five months' business on their books. Deliveries on steel bars that can be rolled on continuous mills can be promised by some of the larger mills within two months, while on other sizes deliveries cannot be promised short of four months. We continue to quote: Bessemer steel bars, 1.60c; open-hearth, 1.70c; plow beams and cultivator beams, 1.60c, net; channels, angles, zees and tees, Bessemer under 3 inches, 1.70c; over 3 inches, 1.80c; bar iron, 1.80c to 1.90c, Pittsburg, with full freight added to point of delivery. Hoops and bands are quoted at 1.90c, full extras, in 250-ton lots and over, and 2c in less than 250-ton lots; refined iron bars, 2.25c and upwards.

PLATES.—The plate situation continues very strong and with additional tonnage being taken on daily, the mills are steadily falling back on their deliveries. It is doubtful if any considerable tonnage now placed could be delivered until after the first of next year. We make the following quotations: Tank plates, ¼-inch thick and up to 100 inches in width, 1.60c at mill, Pittsburg; flange and boiler steel, 1.70c; marine, ordinary firebox, A. B. M. A. specifications, 1.80c; still bottom steel, 1.80c; locomotive firebox, not less than 2.10c, and it ranges in price to 3c. Plate more than 100 inches wide, 5c extra 100 pounds. Plate 3-16 of an inch in thickness, $2 extra; gauges Nos. 7 and 8, $3 extra. These quotations are based on carload lots, with 5 cents extra a hundred pounds for less than carload lots. Terms, net cash, in 30 days.

PIPES AND TUBES.—Current business continues good for this season of the year and all the mills are carrying large tonnages for future deliveries. Prices are being firmly maintained. Quotations to jobbers in carload lots, with freight added to destination, are as follows:

MERCHANT PIPE.

	Black. Per cent.	Galv. Per cent.
⅛ to ⅜ and 11 to 12 inches	60	48
½ to 12 inches	67	55

Discount to consumers in carload lots, Pittsburg, are as follows:

BOILER TUBES.

Steel.

	Per cent.
1 to 1¾ inches	45
2¼ to 5 inches	60½
1¾ to 2¼ and 6 to 13 inches	52½

Iron.

	Per cent.
1 to 1¾ inches	42½
2¼ to 5 inches	50
1¾ to 2¼ and 6 to 13 inches	40

CASING.

	S. and S. Per cent.
2 to 3 inches	58
3¼ to 4 inches	60
4¼ to 12½ inches	63

SHEETS.—Despite the high ruling quotations on spelter a number of the independent mills have been reported cutting the quotations of the American Sheet Steel Co. on galvanized sheets. The situation in black sheets continues unchanged with a fair demand for early deliveries. We make the following quotations: Nos. 10 and 12, 2.40c to 2.50c; 14 and 15, 2.50c to 2.60c; 16, 2.60c; 18 and 20, 2.70c to 2.80c; 22 and 24, 2.80c to 2.90c; 26, 2.90c to 3c; 27, 3c to 3.10c; 28, 3.10c to 3.20c; 29, 3.25c to 3.35c; 30, 3.35c to 3.45c. Galvanized sheets, in carload lots to consumers, are quoted at 3.05c for Nos. 10 and 11, 3.45c for Nos. 18 to 21, 4.20c for No. 27, and 4.50c for No. 28. Galvanized sheets, mill shipments in carload lots to consumers are as follows: Nos. 10 and 11, 3.05c; Nos. 12 to 14, 3.15c; Nos. 15 to 17, 3.25c; Nos. 18 to 21, 3.45c; Nos. 22 to 24, 3.75c; Nos. 25 and 26, 4c; No. 27, 4.25c; No. 28, 4.50c.

WIRE AND WIRE NAILS.—A number of mills continue idle, owing to their inability to secure rods at reasonable prices and it is probable that the mills dependent upon the market for their supply of rods will remain idle until lower prices prevail. Quotations are as follows: Wire nails in carload lots, $2.05 per keg; smaller lots, 2.10 and $2.15; plain wire, $2 in carload lots and $2.10 in less than carload lots to retailers; galvanized wire, $2.40 in carload lots; polished staples, $2.20, and galvanized staples, $2.60; painted barb wire, $2.60, and galvanized, $2.90. These prices are quoted on a Pittsburg base plus the actual freight to destination. Cut nails are held at $2.05 in carload lots and $2.10 in less than carload lots, Pittsburg, plus freight to destination.

MERCHANT STEEL.—The demand is reported strong on all lines of merchant steel and the present prices are being well maintained. The demand for shafting, despite the recent advance, is good. Turned, cold rolled ground shafting in carload lots is quoted 47 off, and in less than carload lots, 42 off; tire steel, 2.25c to 2.30c; toe calk, 2.35c to 2.45c; sleigh shoes, 2.25c to 2.35c; machinery steel, 1.70; smooth machinery steel, 1.75c. Tool steel, 7 cents and upwards.

OLD MATERIAL.—The action of the Erie Railroad outlined in our last issue is having a salutary effect on the market in curtailing fictitious sales. The railroad companies believe that this move will result in their securing somewhat better prices for their product than heretofore when the dealers all over the country were offering the same lot of material for sale over and again. Our quotations for gross tons are as follows: Cast scrap, $18 to $19; heavy melting stock, $21 to $21.50; No. 1

wrought scrap, $22 to $22.25; light rails, relaying purposes, $34 to $38.

COKE.—The Connellsville *Courier* states that the production of the Upper region for the week ending Saturday, July 19, amounted to 249,559 tons which was a slight increase over the production of the previous week. The production of the Lower region amounted to about 35,000 tons. The shipments for both regions were slightly less than those of the week previous. For prompt delivery, furnace coke still commands from $3 to $3.50 per ton. On contracts, furnace coke is quoted at $2.25 and foundry at $2.75 to $3.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
519 MONADNOCK BLOCK, July 29.

So far as this section is concerned, the month of July will be remembered as the period during which the sales of iron and steel products made new high records. There is a pronounced demand for all descriptions of material and the activity shows no sign of abatement. Sales of pig iron in the last week amounted approximately to 100,000 tons. In the previous week, the sales are estimated at 150,000 tons, with nearly corresponding figures for the other weeks of the month. The leading steel rail interest closed the bulk of the 800,000 tons now on its books during this month, and the sales of structural steel, which are placed at between 30,000 and 40,000 tons, are reported to be the largest since Eastern mills established offices in this city. A number of furnaces have already withdrawn from the market for the first half of 1903 and a majority of the others are sold up at least for the first quarter of next year. The Illinois Steel Co. has sold its capacity on standard rails as far as August, 1903; light rails cannot be had prior to November, 1902; bolts, not before October, of this year, and spikes, not until January, 1903. Sellers of structural steel are expecting daily to receive word to sell no more material for any delivery next year, while manufacturers in other lines are making strenuous efforts to catch up on their orders to be prepared for the heavy demand which is expected in the fall. Heretofore, there have been recognized periods for the buying of various products, but all precedents seem now to be thrown on one side and consumers everywhere are buying while it is possible to get promise of delivery.

The market in the past week has been rather quiet as compared with the activity of previous weeks. In the pig iron field, one of the most noteworthy features was the announcement by the leading Southern producer last week that it had opened its books for the sale of iron during 1903. It can take nothing earlier than March, however, and not much for that month.

Several large orders for steel rails are pending, one for 20,000 tons, another for 10,000 tons and numerous smaller lots. About 5,000 tons of structural steel was sold here last week together with a good sized quantity of foreign beams, channels and angles. Though the bar mills report specifications as being very active, new business is not of large proportions. The effort to consolidate the Western bar iron mills, which was made a few weeks ago by Chicago promoters, has failed owing to the unwillingness of some to accept the valuation placed on their property. The concerns included in the scheme were the American Rolling Mill Corporation, Emlyn Iron Works, both of Chicago; National Rolling Mill Co., Hartford City, Ind.; Highland Iron & Steel Co., Terre Haute, Ind.; Hirsch Rolling Mill Co., St. Louis, and another company. Coke is very scarce and is commanding $6 a ton for spot delivery. Scrap is also firm, prices being evenly maintained.

PIG IRON.—While the price of Southern iron for next year's delivery has been fixed at $17, Birmingham, for No. 2 foundry. It is not expected by local sellers that this will be maintained long, as a number of the smaller Southern producers have been quoting $17.50 to $18 at Birmingham. Southern furnacemen are stipulating in each contract that any advance in freight rates which might be made next year will be borne by the purchaser. The freight from Birmingham to Chicago at the present time is $3.65, making the price of No. 2 foundry, $20.65, Chicago. Transactions in the week just closed have been smaller in tonnage, though larger in number. There is a 10,000-ton order pending, but the largest sale of the week was for 6,000 tons, with a few varying from 1,000 to 5,000 tons. The bulk of the tonnage has been in lots of a few hundred tons each. There is a great demand for spot iron which is commanding from $25.65 to $26.15 a ton for No. 1 foundry or soft the highest recorded price ever paid for pig iron in this city. Northern iron is very scarce, the largest local producer being reported out of the market for the first half. An advance in price is contemplated by other concerns having local iron to sell, which probably will be made this week. We have revised our quotations, as follows:

Lake Sup. Charcoal	$24 00 to $24 50	Southern Coke No. 4	$19 65 to $20 65
Local Coke Fdy. No. 1	22 50 to 23 50	Southern No. 1 Soft	21 15 to 22 15
Local Coke Fdy. No. 2	21 50 to 22 50	Southern No. 2 Soft	20 65 to 21 65
Local Coke Fdy. No. 3	22 00 to 23 00	Southern Gray Forge	19 65 to 20 65
Local ScotchFdy. No. 1	22 00 to 23 00	Southern Silveries	22 15 to 23 15
Local ScotchFdy. No. 2	21 50 to 22 50	Jackson Co. Silveries	26 00 to 27 00
Southern Coke No. 1	21 40 to 22 40	Ohio StrongSoftenera	24 10 to 24 60
Southern Coke No. 2	20 65 to 21 65	Alabama Car Wheel	26 00 to 26 50
Southern Coke No. 3	20 15 to 22 15	Malleable Bessemer	22 00 to 23 00

BARS.—Manufacturers report the market is in a healthy condition, and the demand brisk for this time of the year. No very large orders are being booked, though the aggregate of the week's transactions is large. The business is very generally scattered, both as regards territory and purchasers. With the excellent crop outlook, all the mills are looking for an active fall trade. We quote Chicago delivery, Bessemer steel, 1.75c to 1.85c; angles, less than 3x3, 1.85c; iron, 1.85c to 1.95c; hoops, 2.15c. Prices out of store, steel, 2c to 2.10c; iron, 2.20c to 2.25c; hoops, 2.40c to 2.45c; angles, 2.50c to 2.60c.

SHEETS.—Both mills and jobbers report the outlook fairly satisfactory. The summer months are never noted for brisk trade in this material, though specifications and inquiry for future delivery indicate no lessening in general consumption. We quote No. 27 black, mill shipments, Chicago delivery, 3.15c to 3.25c; galvanized, 4.40c to 4.50c; out of store, No. 27 black, 3.35c to 3.50c; galvanized, 4.60c to 4.75c.

STRUCTURAL MATERIAL.—Approximately 40,000 tons has been sold in July, 5,000 of which was closed during the past week, together with a large quantity of foreign material. Store trade is relatively active. We quote mill prices as follows: Beams, 15 inches and under, 1.75c; 18 inches and over, 1.85c; structural angles, 3x3 to 6x6, 1.85c; angles, channels and tees, smaller than 3 inches, 1.85c base; plates, 1.75c. Prices on lots from store are based on the necessities of buyers and according to the size of order. Store prices vary from 2½ to 4 cents a pound.

BILLETS.—The business is still confined to carload lots and particular specifications for which prices suiting the material, the delivery and the tonnage are made. Foreign billets can be laid down in this city at from $31 to $31.50 a ton. A slight falling off.

RAILS AND TRACK SUPPLIES.—There is still a heavy inquiry for standard sections from the large railroad systems for delivery next year. We quote standard rails $28; second quality, $27; light rails, 45 pounds, $34 to $35; 12 pounds, $40 to $41, with regular differentials for intermediate sizes; out of store, $45 to $50; splice bars, 2.25c; spikes, carload lots, 2.45c to 2.55c; track bolts 3½x¾, with square nuts, 3.05c per 100 pounds; with hexagon nuts, 3.20c with usual differentials for others sizes.

MERCHANT STEEL.—Some good sized contracts for tire and spring steel were placed during the week by the carriage manufacturing trade. Business is limited, however, from the fact that mills are generally declining orders, owing to the heavy tonnage already on their books. We quote mill shipments, Chicago delivery, as follows: Smooth finished tire steel, 1.95c to 2c; open-hearth spring steel, 2.65c to 2.75c; sleigh shoe, 1.75c to 1.80c, flat sizes; concave and convex, 2c; out of store, 2.15c; cutter shoe, 2.40c to 2.60c; machinery steel, 2.15c to 2.25c, base; plow steel, 2.50c and upwards, according to quality; toe calk, 2.25c to 2.35c; out of stock, 3c to 3.10c; ordinary tool steel, 6c to 7c; specials, 13c and upwards; less than carload lots, 5 percent to 10 percent higher; cold rolled shafting, carload lots, 50 percent off, Chicago; less than carload lots, 45 percent off, Chicago.

CAST IRON PIPE.—Prices of pipe have again advanced. There is a fair sized demand for the smaller sizes, orders being limited to a few hundred tons each. We quote 4-inch water pipe, Chicago delivery, $35.75; 6-inch and larger, $33.75; gas pipe, $1 a ton higher.

MERCHANT PIPE.—The trade is comparatively quiet, this being the dull season. Increased activity is not expected before

the fall. The demand for boiler tubes has also lessened slightly. Prices are as follows:

MERCHANT PIPE, RANDOM LENGTHS.
(Jobbers, Chicago Basing Discounts.)

	Black Per cent.	Galv. Per cent.
⅛ to ⅜ in. inclusive	58½	46½
¼ to 12 in. inclusive	65½	53½
(Consumers, Chicago Basing Discounts.)		
⅛ to ⅜ in. inclusive	56½	43½
¼ to 12 in. inclusive	63½	50½

BOILER TUBES.

Steel.

	Per cent.
1 to 1¼ in.	35
1¼ to 2¼ in.	45
2¼ to 5 in.	55
6 to 13 in.	47½

Iron.

	Per cent.
1 to 1¼ in.	35
1¼ to 2¼ in.	32½
2¼ to 5 in.	42½

PLATES.—Trade with mills is almost nil, owing to the fact that nothing can be had for delivery this year. Jobbers, however, are receiving many inquiries, and are doing an active business. We quote mill prices, Chicago delivery: Tank steel, ¼-inch and heavier, 1.75c to 2.15c; flange steel, ¼-inch and heavier, 1.85c to 2.25c; from stock, tank steel, ¼-inch and heavier, 2.30c to 2.50c; 3-16, 2.40 to 2.60c; No. 8, 2.45c to 2.65c; flange steel, 2.50c to 2.60.

WIRE AND WIRE NAILS.—The local manufacturer reports that orders are numerous, and as the crop outlook develops these increase both in tonnage and number. An immense business is anticipated this fall, and meantime mills are catching up on back orders in order to be able to cope with it. We quote smooth wire, carloads, $2.15; painted barb wire, $2.75; galvanized barb wire in carload lots, $3.05; wire nails, carload lots, $2.20; staples, carload lots, $2.30; jobbers' prices to retailers, 5 cents higher than above for carload lots, and 10 cents higher for less than carload lots.

COKE.—Coke is very scarce, and for spot delivery is commanding $6 a ton. We quote 72-hour Connellsville foundry, $5.75; Virginia and West Virginia coke, $5.25 to $5.75.

OLD MATERIAL.—While there is not a very brisk demand for scrap, the market loses none of its strength. The mills have not done any considerable buying since the July shutdowns. We have revised our quotations, quoting gross tons as follows:

Old iron rails	$24 00 to $24 50	Relaying rails	31 00 to 34 00
Old steel rails, long lengths	22 50 to 23 00	Old wheels	20 00 to 21 00
Old steel rails, short lengths	18 00 to 19 00	Heavy melting steel	18 00 to 19 00
		Mixed country steel	15 00 to 15 50

The following are selling prices per net ton:

No. 1 R. R wrought	$20 50 to $21 00	Steel axles	$21 00 to $22 00
No. 2 R. R wrought	18 50 to 19 00	Cast borings	9 50 to 10 00
Dealers' forge	16 00 to 17 00	Wrought turnings	13 50 to 14 00
No. 1 busheling	14 00 to 15 00	Iron axle turnings	14 00 to 14 10
No. 1 R. R. & mch. cast	14 50 to 15 00	Steel axle turnings	13 50 to 14 50
Railway malleable	15 50 to 16 50	Stove plates	11 00 to 11 50
Country malleable	14 00 to 14 50	Old iron splice bars	21 00 to 22 00
Iron axles	24 50 to 25 00		

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
1064 ROSE BUILDING, July 30.

Although there have been more delays at both Northern and Southern ports during the month and dispatch the past week has not been entirely satisfactory, the ore brought down during July will not be far from 4,000,000 tons. There are now no indications that rates will change and it is probable that they will hold close to the present figure until late in the season. There have been few inquiries for ore during the week. The prospective sale of the Republic mine has been an interesting subject of discussion, as referred to elsewhere.

PIG IRON.—Foundry men are in a quandary as to buying iron for next year and they are freely asking the advice of sales agents in whom they have confidence. The agents are slow to give advice and the foundrymen in a good many cases are buying at least half of what they expect to use in the first six months of next year. Some of them who were caught in the slump of prices two years ago are slow to buy far ahead, but it is generally admitted that conditions are different now from those of 1900. For the small lots of 1902 iron sold this week, the price was about $24 for No. 2 foundry at the furnace. Many furnaces are sold for their entire produce for the first half of 1903. Some stray lots of imported Scotch iron have been offered in this district at about $26 delivered. We quote the Cleveland market as follows for forward delivery, the lower figures on foundry iron being for shipment in the first half of 1903 and the higher figures for deliveries in the first two or three months of the new year:

Bessemer	$21 75 to $22 25	Scotch No. 1	$22 25 to $22 75
No. 1 Strong F'dry	22 25 to 22 75	Scotch No. 2	21 75 to 22 25
No. 2 Strong F'dry	21 75 to 22 25	Gray forge, Valley	20 00 to 20 50
No. 3 Foundry	21 25 to 21 75	LakeSuperior charc'l	23 00 to 24 00

FINISHED MATERIAL.—The very favorable crop reports, especially for the great wheat and corn raising districts of the West, have had a decided influence in increasing the activity of manufacturers of farming machinery and they are having no little trouble in getting material for this year's needs at satisfactory prices. In the sale of structural material buyers are not only making contracts but are furnishing specifications for orders to be filled as late as April. Prices of tank steel continue from 1.70c to 1.85c, Cleveland, according to sellers and deliveries. The base price for bar iron in 1.80c Pittsburg, and premiums are still being paid for early delivery. We quote steel bars at 1.60c for Bessemer and 1.70c for open-hearth, Pittsburg. Sales out of store, Cleveland, are on a basis of 1.90c to 2c. Sheets are weak, some sellers even finding them a bugbear in the market. We quote 2.10c to 2.15c Cleveland for 3-16-inch and heavier. Cleveland prices are on the following basis on mill sales of black sheets: No. 24, 2.90c to 3c; No. 26, 3c to 3.10c; No. 27, 3.10c to 3.20c; and the following prices out of stock: No. 10, 2.35c to 2.50c; No. 12, 2.45c to 2.60c; No. 14, 2.55 to 2.70c; No. 16, 2.95c to 3c; No. 18, 3c to 3.15c; No. 20, 3.05c to 3.20c; Nos. 22-24, 3.15c to 3.30c; Nos. 22-26, 3.25c to 3.40c; No. 27, 3.35c to 3.50c; No. 28, 3.45c to 3.60c, for one pass cold rolled. On galvanized sheets Cleveland prices to consumers are as follows for carload lots; Nos. 10 and 11, 3.15c; Nos 12 to 14, 3.25c; Nos. 18 to 21, 3.55c; Nos. 22 to 24, 3.85c; No. 27, 4.53c; No. 28, 4.60c. The latest contracts for vessels have still further increased the demands upon structural and plate mills. We continue to quote 1.70c Cleveland for beams and channels for delivery in 1903, business for 1902 being through jobbers at prices from 2½ to 3½c according to sizes and quantity.

OLD MATERIAL.—The market is exceedingly dull. Buyers are evidently holding off with the hope that prices will decline, but there is no indication that such will be the result. Business is never very brisk at this time of the year. We quote Cleveland prices as follows, all on gross tons:

Old iron rails	$ 26 00 to 27 00
Old steel rails (6 ft. and over)	22 00 to 23 00
Old steel rails (6 ft. and under)	20 00 to 21 00
Old car wheels	19 50 to 20 00
No. 1 R. R. wrought scrap	21 00 to 22 00
Mill scrap	20 00 to 20 50
No. 1 machine cast scrap	18 00 to 19 00
Iron axles	28 00 to 29 00
Axle turnings	18 00 to 18 50
Wrought turnings (free from cast)	14 50 to 15 50
Cast borings	10 50 to 11 00
Uncut wrought iron boilers	11 00 to 12 00
Steel boiler plates	16 00 to 17 00
Grate bars	11 50 to 12 50
Pipes and flues (clean)	17 00 to 18 00
Tank iron	17 00 to 18 00
Hoop and band iron	13 50 to 14 50
Sheet iron	11 50 to 12 00
Wrought drillings	14 50 to 15 00
Malleable iron	17 00 to 18 00
Stove plate	13 00 to 14 00
Heavy steel	19 00 to 20 00

CINCINNATI.

July 29.

In spite of the fact that a great many business men have gone on their vacations and have left matters in a sort of unsettled state during their absence there seems to be plenty of them at home to make the iron business as active as could be expected. In the several branches of the trade the demand has been good, and the volume of business is still large. As far as pig iron is concerned business is a little quiet. This is due more to the fact that the producers are not anxious to sell than that the consumers are not anxious to buy. Deliveries of finished material are more unsatisfactory than ever from the standpoint of the purchaser and this ns a good indication of the volume of business in that direction.

PIG IRON.—A peculiar situation exists among some of the pig iron producers. This week the largest of the Southern producers, which has been out of the market for many weeks, decided to re-enter the market and sell iron for delivery during the second quarter of 1903. One of the other large Southern producers, which had been selling iron for 1903 delivery for

some time, found that the result of the action of the other company was that it was selling iron for the second quarter and allowing consumers to rely on the second named concern for the first quarter. The result of this was that the second named concern issued orders to its agents to sell iron for delivery in March only of the first three months of the year, and then on the condition that the purchasers would purchase as much iron for delivery during April, May and June as they purchased for delivery during March. In this way the second named concern intends to see to it that consumers of pig iron will not buy all of its first quarter iron and leave it with its second quarter iron on hand. The result of it is that the Southern furnaces are now fairly in the field and will probably sell iron for delivery during the first half unless there are farther developments. It is intimated, however, and the local agent of one of the large companies expresses the belief that his company will shortly withdraw from the market for the time being at least, in so far as the sale of iron for the first half of 1903 is concerned.

The demand for pig iron has been quite good during the past week and numerous transactions of 1,000 ton lots have been made. The price is mainly on the basis of $17 for No. 2 at Birmingham. Sales are made subject to any change in the freight rate, the purchaser assuming the risk. Northern irons have been in good demand and at good prices, most of the Northern furnaces selling in this district having little to offer for early delivery. One of the largest furnaces in the south, the La Follette, will be blown in this week with a capacity of about 250 tons. Practically all of the Southern furnaces are now in blast and are producing up to their full capacity. Following are prices at Cincinnati:

Southern Fdy. No. 1	$20 25 to 21 75	Gray Forge	$19 00 to 20 00
" " 2	19 75 to 21 25	Northern Fdy. No. 1	24 60 to 26 60
" " 3	19 25 to 20 75	" " 2	24 10 to 26 10
" " 4	18 75 to 20 25	Southern C. W. iron	25 25 to 25 75
So. Fdy. No. 1 soft	20 25 to 21 75	Malleable coke iron	22 75 to 23 50
So. Fdy. No. 2 soft	19 75 to 20 75		

FINISHED MATERIAL.—Manufacturing concerns that use iron and steel in various shapes are buying heavily of finished material, and this is especially true of such concerns as do not have a seasonable business, that is, a business that runs heavier in the fall or spring. For example, safe manufacturers are buying heavily of sheets, plates, angles and the like, while vehicle manufacturers are not in the market so heavily. Machine tool builders are large buyers of bars both iron and steel, and from the amount of their purchases one can estimate that they are enjoying a very good trade. There have been no changes in the prices. Bar iron remains at 1.92c and steel bars at 1.72c, both being quoted at 2.20c out of store. Angles are 2.35c and 2.50c out of store. Sheets are quoted at 2.50c for No. 12 and 2.35c for No. 10.

OLD MATERIAL.—There is no change in the scrap market either as regards prices or the movement. There is not a great amount of business in scrap iron and not much offered. On the other hand there seems to be no material strengthening of prices which remain as follows:

Old No 1. Wrought Railroad, net tons	$ 20 50 to 21 00
Cast Machine and Foundry, net tons	14 50 to 15 00
Old Iron Rails, gross tons	25 00
Old Steel Rails, gross tons	24 00
Old Short Lengths, gross tons	17 50 to 18 00
Old Iron Axles, gross tons	26 75 to 27 00
Old Iron Car Wheels, gross tons	19 50 to 20 00
Stove Plates, gross tons	11 00 to 11 25
Wrought Turnings, net tons	14 50 to 15 00
Cast Borings, net tons	9 50 to 9 75

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1909, NO. 150 NASSAU ST., July 29

PIG IRON.—During the past week evidences were given of considerable activity. The pace set by the West in making itself felt here, the past few days bringing to the front more inquiries than in the same time for weeks past. The majority of business done was in Southern No. 2 iron, and the sales easily amounted to 20,000 tons, on the basis of $17 at Birmingham. Buyers seem more disposed to provide for next year's requirements than they were a week ago. Several interests that were reluctant a short time ago to buy for next year now believe that prudence dictates the purchase of iron for a part of their probable needs in the first half. Northern iron is not receiving much attention. Sales agents of Northern producers say their companies are averse to commitments for next year's iron until the labor difficulties by which they are beset, and the evils incident to them, have disappeared. Yet inquiries of good proportions are being made, and some sales are recorded of No. 2 X foundry iron on the basis of $21 at the furnace. During the week several carloads of spot iron made their appearance in this vicinity, and they were taken up eagerly, the prices being $26 for No. 1 X, and $25 for No. 2 X. Foreign irons continue to come in in good-sized lots, much to the relief of those who have to make provision for this year's wants. So far as can be learned foreign producers have not yet made sales in the United States for delivery in 1903, and probably will not until the supply of material they have for sale this year is exhausted. New York prices for summer delivery are as follows: No. 1 X, $23.50 to $25; No. 2 X, $22.75 to $23.50; No. 2 plain, $22.25 to $22.50; No. 1 foundry, Southern, $22 to $23; No. 2 foundry, Southern, $21.75 to $22.50; No. 3 foundry, Southern, $21.25 to $22.75; No. 4 foundry, Southern, $20.75 to $21.25.

FINISHED IRON AND STEEL.—Buyers in the market for structural material for spot delivery are having great difficulty filling their orders. Some unusual premiums are said to have been paid recently. The governing price for spot delivery, according to the representative of a large mill is the "respect" in which the purchaser is held. The market for structural shapes for next year's delivery is fast shaping up. All the mills say they can easily find sale for their entire output for the first six months of next year, and orders have already been given which will extend into the third quarter of the year. Sheared steel plates continue to be in good demand, with high premiums easily obtainable for immediate delivery. In sheets there are reports of lower prices among independent mills, but in some cases the weakness has not proved equal to the report. New York prices are as follows: Beams and channels, 15 inches and under, 1.75c to 1.90c; angles, 3 to 6 inches, 1.75 to 1.95c; zees, 1.75c to 1.95c; bulb angles, 2.05c to 2.25c; deck beams, 2.05c to 2.25c; sheared steel plates, tank, 2.10c to 2.15c; flange, 2.25c to 2.30c; firebox, 2.30c to 3.50c. Refined bars, 1.95c to 2c; soft steel bars, 1.95c to 2.05c. Sheet steel, in carloads, New York, No. 28 black, 3.18c to 3.25c; No. 28 galvanized, 70 and 10 off.

PHILADELPHIA.

July 29.

Foreign iron has been coming in so rapidly in the past week that the fear of greater scarcity than there has been for several months is disappearing. Business is in excellent condition and the demand for iron and steel continues as strong as ever, but on account of large imports buyers are not so anxious about contracting for next year's delivery. There is a growing feeling that the coal miners' strike will soon be ended, but there is really little evidence to show that the conflict is nearing its end.

PIG IRON.—A rather apathetic feeling prevails in the iron market. Iron for prompt shipment is scarce except that more of the foreign is coming in. Scotch iron sells at $22 to $22.50 ex-ship duty paid and Middlesboro foundry at $1 to $1.50 less. Prices are not essentially different, but buyers are more reluctant. The following are about the prices for the last quarter of 1902 and the first half of 1903: No. 1 X foundry, $23.50 to $24.50; No. 2 X foundry, $22 to $22.50; No. 2 plain, $21.50 to $22; standard grey forge, $20.50 to $21.50; basic, $20.50 to $21; low phosphorus, $23 to $23.50.

BILLETS.—The demand for billets is not quite so strong, but steel for prompt delivery from American mills is still hard to get. Foreign steel could be had at about $29 for August and September, and domestic steel would bring two or three dollars more. Nominal quotations for ordinary Bessemer (American) are about $32.50 to $33. Open-hearth steel, $34 to $35.

FINISHED MATERIAL.—The demand for plates is strong and they are hard to get. Bars are in good demand also and there is plenty of business at full quoted prices. Prices are about as follows: Plates, small lots, 2.10c to 2.15c; carload lots and upward, ¼-inch and thicker, 2c to 2.05c; universals, 2c to 2.05c; flange, 2.10c to 2.20c; firebox, 2.25c to 2.30c; marine, 2.30c to 2.35c. Soft steel bars are held at 2c to 2.15c; refined

[Continued on page 48.]

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AN IMPOSING ARRAY OF NEW CAPACITY.

Several pages of this issue of *The Iron Trade Review* are taken up with an enumeration of the new plants now under construction in the United States for the manufacture of iron and steel. It is an impressive exhibit and one of peculiar interest in a time when consumers of pig iron, of steel billets and of some forms of finished steel are unable to get sufficient material to operate steadily, and when producers are weeks behind orders and have their capacity sold for months ahead. But there is nothing surprising or contradictory in the current market story and that of the long list of new and projected plants. The new enterprises are a product of the conditions that showed themselves in 1899, less prominently in 1900, again strikingly in 1901, and accented increasingly since the beginning of the present year.

The four pages of new companies and their new plants and of old companies and their extensions suggest that 1903 before its close will bring a large measure of relief from the troubles that have beset the iron trade in 1902. With 34 new blast furnaces under construction having an annual capacity of 4,300,000 tons, and with enlargements under way adding 600,000 tons a year more, it might be judged that scarcity of iron and high prices would not long embarrass consuming interests. The situation hinges on the availability of this new furnace plant. Most of it will run on steel making pig iron, and it is also true that the furnaces that will make Bessemer or basic iron will furnish far the greater part of the contribution of this new capacity to the pig iron production of 1902. Relatively little foundry iron will come from these new furnaces before the middle of 1903. But the important fact is that within 16 or 17 months the effective pig iron producing capacity of the country will be about 23,000,000 tons, as against a probable output of 18,000,000 tons, possibly something more than this, for 1902, while in 1901 we had the record breaking output of 15,878,354 tons and in 1900, 13,789,242 tons. It would seem that the year 1904 will open with an ample supply of pig iron for all comers.

However, the experiences of the past eight months have taught the iron trade that capacity, even efficient capacity, is one thing and output another. It is certain that the coke making capacity of the country has not expanded and does not promise immediately to expand at an equal pace with the blast furnace capacity. This year the lack of cars and locomotives to haul the coke has been a chief drawback. Another year should find the condition greatly improved.

So far as steel is concerned, it would seem that famine or suggestion of famine will not be known in 1903. The lack of pig iron for the converter or the open-hearth furnace has been a prime cause of the steel scarcity of the present year. The coming in of 1903 will show a good increase in the supply of steel-making pig and the middle of next year a still greater increase. In the list of new steel works it will be seen that the only additions to Bessemer capacity are the increases under way at Buffalo and at Youngstown. In open-hearth works there is a flood of new construction. The most important are by companies having their own blast furnaces; but significant additions are those of concerns that have heretofore bought steel in the market for their finishing plants. Merchant production of basic pig must increase considerably to take care of these, for the drain upon scrap is more and more pronounced. That a new tonnage of 3,000,000 a year will be added to our open-hearth plant before 1904 seems almost incredible. For 1901 the production was 4,656,309 tons of open-hearth steel. It might easily be 6,000,000 tons for 1902 and 8,000,000 tons for 1903, which would be within 700,000 tons of the Bessemer steel production in 1901. The overhauling of Bessemer by open-hearth is rapid.

In connection with the list of new tin plate and sheet mills now going up, it is to be noted that in both these lines there is today more capacity than the country's wants will employ in the midst of prosperity. The necessity of making a strenuous effort to keep at home the tin plate business now going to Wales will be emphasized in the coming year.

That the plate mill capacity of the country will soon be more than adequate to the demand is a natural inference from the statement of new mills under way. The Lukens Iron & Steel Co. and the Cambria Steel Co. will each have a new and modern mill in operation in the coming fall, and Worth Bros. have one of like capacity under way, to be finished in the early part of 1903. The Lackawanna Steel Co. and the Colorado Fuel & Iron Co. have also large plate mills in plan. The prospect is, therefore, for an output of about 500,000 tons a year more than that of today. In contrast with this tendency to over-production is the continued shortage in structural material, with no new producers entering the field save the Lackawanna Steel Co., whose mill will not be ready until well into 1903. Undoubtedly the United State Steel Corporation has an enlargement of its structural capacity provided for in its schedule of new work, and the Chicago District furnishes a good field for such extension.

In the production of wrought pipe there is no indi-

cation of serious over-doing. The Youngstown plant has started and the Sharon plant will be ready before the end of the year. A Central Pennsylvania plant is also under construction. So far as plants with connected steel works are concerned, the steel corporation has less competition, present and prospective, in wrought pipe and tubes than in any other line.

The wire and wire nail industries, already well crowded, will be more so when the Colorado and Pittsburg District plants are in full operation. In bars comparatively few additional mills are coming forward. The field is not an attractive one, being now well occupied, and affording no great promise except to continuous mills with connected steel supply.

With the single exception of structural material, the exhibit elsewhere would go to show that another year may bring some uncomfortable elbowing in the iron trade.

THE PREMIUM SYSTEM IN THE OFFICE.

The application of a method of encouraging sustained effort by workmen is just as needful in the office as in the shop and the benefits of a premium system applied to purely clerical purposes has already received some attention in the columns of *The Iron Trade Review* in describing the arrangement in vogue on the Italian railroads. The subject comes up anew in a letter sent by a consulting engineer of Birmingham to *Engineering*, of London. Mr. Charles Baddingley, the writer of the communication, says:

"I beg to ask if any could give me a system that would encourage the rest of a staff. We have heard so much lately about premium systems for the men, but I think something is needed for the rest of a staff. The only system I have seen was one for the draughtsmen at a motor works in Paris (Peugeot's, I believe), and their rule was to give a tool-designer an interest in the labor saved by his devices, by capitalizing it according to a fixed scale, in addition to his salary."

There is equally the need of promoting the interest of the designer, of stimulating his zeal, as there can possibly be in the case of the other employes. His work is of such a character indeed that any improvement h can devise is quite likely to have an influence over a wider range than the labor of a painstaking lathesman, for instance, the jig or other tool being comparable to the rest of the machinery in the shop and having a like permanence and value. Excluding the toolmaker whose work approaches the more closely to that of the tool designer, the difference between the workman at the drafting table and the employe at the lathe is in the matter of repetition. The one design may serve for many machines or several tools, but the most desirable feature of the practice of the lathesman appears in a succession of the same series of operations. It is this latter characteristic that opens up the opportunities for a system of increasing the reward of the workman as his greater skill and vigor in the performance of the successive tasks at the lathe shall determine.

The premium plan, on account of this radical difference under ordinary conditions, is not so nearly applicable to the work of the designer. The payment of a premium for an increase of product is desirable in either case but there are difficulties in the application of the system to the drafting room which, so far as we know, have prevented a general adoption of such a method in any shop.

Assuming that the tool designer can have the oversight of his designs when they are crystallizing into form and substance in metal as well as when they are put into service, and assuming further that the designer is a practical workman himself with a good acquaintance with human nature and possibilities, it seems very likely indeed that here the premium plan might be introduced for his benefit and that of his assiciates. The estimation of the saving of time obtained by such a method would appear to be derived with less complication than any process of tool capitalization on a fixed scale that we can imagine. It is too early, however, to condemn the latter system without further particulars of its working and success. Meantime the application of the premium plan to the drafting room suggests a few interesting problems in office manipulation.

UNPRECEDENTED PIG IRON PRODUCTION.

The statistics of the American Iron and Steel Association, which appear elsewhere in this issue, show a new record for the blast furnaces of the United States —8,808,574 gross tons of pig iron in the first half of 1902. This is at the rate of 17,617,148 tons a year, as against 15,878,354 tons for 1901. However, unless the entirely unexpected happens, there will be an increase in production month by month, in the remainder of the year, so that a total for 1902 in excess of 18,000,000 gross tons is not improbable.

The increase in production in the first half of 1902, as compared with the second half of 1901 has been marked in basic iron and in foundry and forge irons. In Bessemer iron the increase was 91,326 tons, in basic 249,529 tons and in foundry and forge irons 263,978 tons. The following figures indicate the status in the past three half-year periods:

	First Half 1901.	Second Half 1901.	First Half 1002.
Bessemer iron	4,582,187	5,014,606	5,105,932
Basic iron	645,105	803,745	1,053,274
Foundry and forge iron ..	2,447,321	2,385,390	2,649,368
	7,674,613	8,203,741	8,808,574

The figures indicate that basic steel making has been making steady headway, while the output of Bessemer steel has increased but little. They indicate also an increased production of puddled iron or of iron castings,—or of both, which is no doubt the fact—in the past six months. Our production of Bessemer and open-hearth steel is now doubtless at the rate of more than 15,000,000 tons a year.

New Sheet and Tin Plate Mills.

(Special Telegram.)

PITTSBURG, July 30.—The Follansbee Bros. Co., of this city, has broken ground for the erection of a four-mill sheet and a four-mill tin plate plant at Mahan Station, 46 miles from Pittsburg on the Pan-Handle Railroad. A site of 200 acres has been secured along the Ohio River. The plant will occupy about 15 acres and the remainder will probably be laid out in lots.

In addition to the eight mills the plant will contain sufficient cold rolling capacity for all the black plate and sheets produced and a galvanizing and corrugating plant will also be operated. The main building will be 480 feet long on one side and 440 on the other side and will be 205 feet wide with Ls on each end. There will be 16 sheet and pair furnaces and 9 gas producers. The boiler house will be 90x45 feet. A machine shop, tinhouse and warehouse will also be erected. The erection of an open-hearth plant is under consideration although it will be some time before anything definite in this respect will be decided. The tinning plant located in Allegheny is to be removed to the site of the new plant within a few months. The company is capitalized at $800,000 and operates a large jobbing house in this city.

New Blast Furnaces, Steel Works and Rolling Mills Now Under Construction in the United States.

The extent of the new capacity now being provided in the United States for the production of iron and steel is probably not well appreciated. *The Iron Trade Review* has taken some pains to gather information concerning new work under way or soon to be started, and the result of the inquiry is presented below. It shows not only that the iron and steel industry is an important contributor to its own unprecedented prosperity, but that a very large additional capacity in blast furnace and steel plants and in various lines of finished material will be active by the middle of 1903, while some of it will help to swell production in the late months of 1902 and the early months of next year. The showing is a most impressive one and is well worth the study of every manufacturer of iron and steel. As is well known the program of the United States Steel Corporation for the enlargement of its capacity in important lines is not yet made public; but it is known to involve an expenditure of tens of millions and will furnish a volume of work that will be a distinct stimulus to iron working and engineering trades while it is in progress. Some extensions of plant by subsidiary companies have been announced, however, being in the ordinary course of tihngs, and these are referred to below.

An exact summation of the capacity represented by the new construction in various lines is difficult; particularly so is a definite statement as to the time within which this new capacity will be contributing to our production, already enormous measured by any standards but those created by the iron industry of the United States in the past two years. But enough data are available to permit of approximate statements that will throw some light on the relation of supply and demand within the next 12 months. A brief summary of the exhibit is as follows:

Blast furnaces now under construction in the United States, 34, with estimated annual capacity of 4,300,000 tons. Blast furnaces now being remodeled and enlarged, or soon to be reconstructed, 12. Additional capacity thus provided, about 1,650 tons a day or 600,000 tons a year. Total estimated addition to blast furnace capacity, all expected to be available before the end of 1903, 4,900,000 tons a year.

Open-hearth furnaces under construction, 103, with a daily capacity of 8,900 tons and an annual capacity of about 2,700,000 tons. Open-hearth furnaces planned, 15, with daily capacity of 1,380 tons, or about 400,000 tons annually. Open-hearth furnaces building for steel foundries, 21, with a daily capacity of 650 tons, or about 200,000 a year. Total additional open-hearth capacity available by the close of 1903, 3,300,000 tons a year.

New sheet mills under erection, 67, with an annual capacity of 200,000 tons.

New tin plate mills under construction by independent interests, 59, with an annual capacity of 120,000 tons.

The list of miscellaneous finishing mills under construction includes five modern plate mills with annual capacity of 500,000 tons, new tube, bar, hoop, wire and structural mills of a capacity difficult to estimate, but judging from the capacity of connected open-hearth furnaces, probably equivalent to 1,250,000 to 1,500,000 tons of finished material a year, a small portion of it to be in operation in 1902, and all of it probably by the end of 1903.

BLAST FURNACES.

A Summary of New Construction.

The Cleveland Furnace Co., Cleveland, O., is erecting a stack 85x20 feet to run on foundry iron with a daily capacity of 400 tons. Will be placed in operation in summer of 1903.

The Toledo Furnace Co., Toledo, O., are erecting a furnace 80x20 feet at Toledo, O., with a daily capacity of 400 tons to be operated on foundry iron. Will be in operation in summer of 1903.

The Pioneer Iron Co. (Cleveland-Cliffs Iron Co., of Cleveland) has under construction a charcoal furnace at Presque Isle, Marquette, Mich., with a daily capacity of 200 tons. In operation after January 1, 1903.

The South Chicago Furnace Co., South Chicago, Ill., is building a furnace 81x19½ feet with a daily capacity of 400 tons, to operate on foundry iron. Will be in operation in the summer of 1903.

The Detroit Iron & Steel Co., Detroit, Mich., is erecting a blast furnace on Zug Island, River Rouge, in the Detroit River. The stack will be 77 feet high and will have a 17½ foot bosh. Daily capacity, 300 tons of foundry iron. Will not be completed until after July 1, 1903.

The Rochester & Pittsburg Coal & Iron Co., DuBois, Pa., are building a stack 80 feet high by 20 foot bosh. Will operate on foundry iron, with a daily capacity of 350 tons. Not to be completed until after Jan. 1, 1903.

The Sharon Steel Co., Sharon, Pa., has one furnace under erection with a daily capacity of 400 tons. Another will follow shortly and both will be in operation in 1903 with a daily capacity of 800 tons. The product will be basic pig iron.

The Colorado Fuel & Iron Co., Denver, Col., has one furnace under construction at Pueblo with a daily capacity of 400 tons to run on Bessemer iron. Will be in operation sometime in 1903. The erection of two additional furnaces is in contemplation, but no yet undertaken.

The Buffalo & Susquehanna Iron Co., Buffalo, N. Y., is erecting two furnaces with a daily capacity of 400 tons each. The product will consist of forge and foundry iron. The furnaces will be placed in operation in summer or fall of 1903.

Joseph Wharton, of Philadelphia, is erecting a third furnace at Wharton (formerly Port Oram), N. J., 100 feet high and 21 feet at bosh. The furnace will run on foundry iron and will probably be blown in the latter part of this year. Daily capacity, 400 tons.

The Central Iron & Coal Co. is erecting a furnace at Tuscaloosa, Ala., to be 85 feet high by 18 feet bosh. Daily capacity, about 200 tons. Product, foundry iron. Stack will not be placed in operation until spring or summer of 1903.

The Woodward Iron Co., Woodward, Ala., will erect a new stack with a daily capacity of 200 tons of foundry iron. The product will not be available until some time in 1903.

The Lackawanna Steel Co., Buffalo, N. Y., is erecting four furnaces, two of them 100x25 feet with a daily output of 700 to 800 tons each, and is building two others from its three dismantled Scranton, Pa., stacks. Eventually the plant will consist of six furnaces. They will produce Bessemer and basic iron. The rebuilt furnaces will probably be started in October and the other two early in 1903.

The St. Clair Steel Co. is erecting three furnaces at Clairton, Pa., each to have a daily output of 500 tons. The furnaces will operate on Bessemer and basic iron. One will be blown in about October this year, and the remaining two probably early in 1903.

The Union Steel Co. has two furnaces under erection at Donora, Pa., with a daily output of 500 tons each. They will produce basic iron and will not be in operation until some time

in 1903. Two additional furnaces are likely to be built later.

The Cambria Steel Co., Johnstown, Pa., has under contemplation the erection of a large furnace at an early date to be followed later by three additional furnaces. These furnaces are to have a daily capacity of about 500 tons each and will operate on Bessemer and basic iron.

The Tacoma Steel Co., Tacoma, Wash., has broken ground for the erection of a 250-ton blast furnace. Will be completed next year.

The Alabama Consolidated Coal & Iron Co. is erecting a new coke furnace at Gadsden, Ala., 85x19 feet, with an output of 250 to 300 tons a day.

Work will begin at once on a new modern furnace for the Penn Iron & Coal Co., Canal Dover, O., on the site of the old stack, now being dismantled. The new furnace will be 85x20 feet, with a capacity of over 400 tons a day, and will be ready for blast in the early part of 1903.

The Dover Iron Co., of Bear Spring, Tenn., is building a new charcoal furnace near Bear Spring. It will be 40x9½ feet and will have a daily capacity of about 14 tons.

The Big Stone Gap Iron Co., of Big Stone Gap, Va., is completing Polly Furnace, on which foundation work was done in 1892. The stack will be blown in early in 1903.

The Northside Iron Co., Sharpsville, Pa., has its new coke furnace 35x7 feet nearly completed. Estimated capacity, 18,000 tons a year.

The Elk Rapids Iron Co. will begin at once to dismantle its charcoal furnace at Elk Rapids, Mich. A new stack will be built, 64x11 feet, ready in December.

The Lukens Iron & Steel Co., of Coatesville, Pa., has purchased property on which to erect blast furnaces, but does not intend for the immediate present to start work on them.

Blast furnaces under erection by the constituent companies of the United States Steel Corporation: Carnegie Steel Co.—New stack under erection at the Carrie plant with a daily output of 600 tons. This plant is located at Rankin, Pa., and four large stacks are already in operation. The output will consist of basic iron. The furnace will not be available until next year. Two stacks are being added to the Edgar Thomson works, Braddock, Pa., with a daily capacity of 500 tons each. These will make Bessemer iron and will not be in operation until sometime in 1903. It is understood that two additional furnaces at Duquesne are also in contemplation. National Steel Co.—An additional stack is being built at Youngstown, O., with a daily output of 700 tons. It will make Bessemer iron and will not be available until 1903. National Tube Co.—A new stack with a daily output of 500 tons is nearing completion at Benwood, W. Va. This furnace will make Bessemer iron. It is probable that it will be blown in in October or Nevomber.

Furnaces Rebuilt and Enlarged.

Blast furnaces that are being remodeled are the following:

The Zenith Furnace Co., Duluth, Minn., is remodeling its plant and when additions and repairs are completed the furnace will have a daily output of 225 tons daily instead of 160 tons. This furnace will be placed in operation this year.

Charlotte Furnace, Charlotte, Munroe County, N. Y. (Corrigan, McKinney & Co., of Cleveland), is being repaired and relined, ore trestles are being built and the tuyeres are being increased to 12. The furnace will resume about Sept. 1, with a daily capacity of 200 tons.

The LaBelle Iron Works, Steubenville, O., are rebuilding their blast furnace which will be blown in early in 1903 with a daily capacity of about 400 tons, as against 200 tons formerly. It will make basic iron.

Jones & Laughlins, Ltd., Pittsburg, are making repairs on their Soho furnace. A large amount of new machinery is also being installed together with an automatic skip hoist. The furnace is not being enlarged, however. Operations will be resumed in October. Daily capacity, about 350 tons.

No. 1 furnace of the Andover Iron Co., Phillipsburg, N. J., is being rebuilt and the output is being increased from 125 tons daily to 200 tons. Will be placed in operation this year. The new stack will be 90x18.

Standish Furnace of the Chateaugay Ore & Iron Co., Standish, N. Y., idle for many years, is being rebuilt. It will make charcoal iron and will be ready in 1903.

The Eastern Steel Co., Pottsville, Pa., is overhauling and repairing two old Pioneer stacks, Nos. 2 and 3. The latter will be placed in operation first. They have both been idle for a number of years. Will use Cuban ores.

Among United States Steel Corporation furnaces that will be reconstructed are two National Steel Co. stacks at New Castle, Pa. They will be entirely rebuilt and their daily capacity increased from 200 to 500 tons each. The remodeled furnaces will not be in operation until after January, 1903. The work will soon be begun. Two Isabella furnaces of the American Steel Hoop Co., are being enlarged from 250 tons to 400 tons daily capacity.

NEW OPEN-HEARTH CAPACITY.

More than One Hundred Furnaces Building or Planned.

Open-hearth steel plants projected and under erection:

The Youngstown Iron Sheet & Tube Co., Youngstown, O., will build 12 50-ton open-hearth furnaces. Six are to be laid down at first.

The Sharon Steel Hoop Co. has four 40-ton open-hearth furnaces, with a daily capacity of 300 tons under erection. These will be completed this year.

The LaBelle Iron Works, Steubenville, O., are completing six 50-ton open-hearth furnaces with a daily capacity of 600 tons. These will be in operation shortly. Four additional furnaces of the same size are projected.

The Norwalk Steel & Iron Co., Norwalk, O., is building one 15-ton open-hearth furnace with a daily capacity of 30 tons. Will be placed in operation shortly.

The Union Steel Co., Donora, Pa., is to build twelve 50-ton open-hearth furnaces, with a daily output of 1,200 tons. Part of this plant will be placed in operation this year.

The St. Clair Steel Co., Clairton, Pa., is completing ten 50-ton open-hearth furnaces with a daily capacity of 1,000 tons. Plant will be placed in operation next month.

The Wheeling Roofing & Cornice Co., Wheeling, W. Va., is building one 35-ton open-hearth furnace with a daily capacity of 75 tons.

Worth Bros. & Co., Coatesville, Pa., have under erection four 50-ton open-hearth furnaces with a daily capacity of 400 tons. This plant will be completed early next year.

The C. Pardee Works, Perth Amboy, N. J., are erecting two 25-ton open-hearth furnaces with a daily capacity of 100 tons. The plant will be in operation early next year.

The Vulcan Crucible Co., Aliquippa, Pa., is adding one 10-ton open-hearth furnace with a daily capacity of 20 tons. Will be completed this year.

The Chrome Steel Co., Carteret, N. J., is building two acid open-hearth furnaces of 15 tons capacity and with a daily output of 60 tons. They will be in operation this year.

The Deering Harvester Co. will erect at South Chicago an open-hearth furnace plant with a daily capacity of about 600 tons. These furnaces will not be completed until next year.

The Sharon Steel Co. has four 50-ton open-hearth furnaces under erection with a daily capacity of about 400 tons. The plant will be in operation before the end of the year.

Wickwire Bros., Cortland, N. Y., are building three 35-ton open-hearth furnaces with a daily capacity of 200 tons. Will be in operation this year.

The Alan Wood Iron & Steel Co., Conshohocken, Pa., is building five 50-ton open-hearth furnaces with a daily capacity of 500 tons. They will be placed in operation this year.

Tacoma Steel Co., Tacoma, Wash., is considering the erection of an open-hearth plant.

The West Carnegie Sheet Steel Co., West Carnegie, Pa., will erect two 25-ton open-hearth furnaces with a daily capacity of 100 tons. The plant will be placed in operation next year.

The Portsmouth Steel Co., Portsmouth, O., contemplates the erection of two additional open-hearth furnaces with a daily capacity of 140 tons.

The Rolling Mill Co. of America, Morgantown, W. Va., has three 35-ton open-hearth furnaces under erection with a daily capacity of 200 tons. Will not be in operation until next year.

The Central Iron & Steel Co., Harrisburg, Pa., has under

erection four 50-ton open-hearth furnaces with a daily output of 400 tons.

The Harrisburg Pipe & Pipe Bending Co., Harrisburg, Pa., is adding an open-hearth furnace with a daily capacity of 60 tons.

The Ohio Steel & Iron Specialty Co., Cuyahoga Falls, O., is installing a 25-ton open-hearth furnace with a daily capacity of 50 tons. Will be in operation this year.

The Colorado Fuel & Iron Co., Denver, Col., is adding an open-hearth plant to contain six 50-ton open-hearth furnaces. It is probable that the plant will be in operation late this year. The daily output will amout to 600 tons.

The Glasgow Iron Co. is considering the erection of three 40-ton open-hearth furnaces at Pottstown, Pa. A definite decision will shortly be reached. The daily capacity of these furnaces will be 240 tons.

The United Steel Co., Canton, O., has plans completed for the erection of two open-hearth furnaces of 35 tons capacity each. The daily output of the plant will amount to 140 tons. It will not be completed this year.

The Eastern Steel Co., Pottsville, Pa., is erecting two 35-ton open-hearth furnaces and later may add two more. The two under way replace dismantled furnaces.

The American Rolling Mill Co., of Middletown, O., is building one 40-ton open-hearth furnace, to be ready this year.

The Lackawanna Steel Co.'s steel plant at West Seneca, near Buffalo, in addition to the Bessemer works which will be the rebuilding and enlarging of the Scranton Bessemer mill, and will have four converters, will have four 200-ton Talbot furnaces, the combined capacity of the Bessemer and open-hearth plants being 1,250,000 tons a year. Part of the Bessemer plant will be ready this year, but none of the open-hearth plant will be started until 1903.

At the Wilmot & Hobbs plant of the American Tube & Stamping Co., Bridgeport, Conn., open-hearth furnaces with a daily capacity of 200 tons are being built.

The Firth-Sterling Steel Co., works at Demmler, Pa., is installing one 5-ton open-hearth furnace; daily capacity 10 tons.

The Grand Crossing Tack Co., Grand Crossing, Ill., will built three open-hearth furnaces, probably of 30 tons capacity each.

Total number of furnaces under erection, 103, with a daily capacity of 8,900 tons and an annual capacity of about 2,700,000 tons of steel. There are 15 furnaces contemplated with a daily capacity of 1,380 tons or about 400,000 tons annually.

OPEN-HEARTH FURNACES FOR FOUNDRIES.

Open-hearth furnaces under erection and projected in connection with steel casting plants or foundries:

The John Rice Foundry & Machine Co., Stevens Point, Wis., is installing a 15-ton open-hearth furnace.

The Youngstown Steel Casting Co., Youngstown, O., is about starting a 15-ton open-hearth furnace.

The Buckeye Malleable Iron & Coupler Co., Columbus, O., has nearly completed three open-hearth furnaces, two of 20 tons and one of 10 tons capacity and has started on a fourth which will be a 20-ton furnace.

Lloyd Booth plant of the United Engineering & Foundry Co., Youngstown, O., is adding one 15-ton furnace.

Buffalo Foundry Co., Buffalo, N. Y., is building one 15-ton furnace.

The Commonwealth Steel Co., of Granite City, Ill., is building three 20-ton open-hearth furnaces for its extensive steel foundry now nearing completion.

At the Wellman-Seaver-Morgan Engineering Co.'s new foundry, Cleveland, two 20-ton open-hearth furnaces are under construction.

The McCormick Harvester Co., Chicago, is installing an open-hearth plant of two furnaces of 12 tons capacity each. This company is understood to be canvassing the erection of a steel plant and rolling mills.

Sargent Co., of Chicago, is adding one 20-ton furnace to its steel foundry equipment at 59th and Wallace Sts., Chicago.

Leighton & Howard Steel Co., Granite City, Ill., is adding to its open-hearth capacity, but we have not the details.

The Matthews Steel Casting Co., Matthews, Ind., has begun the erection of a steel casting plant at Matthews, Ind., with a daily capacity of 30 tons.

The Fort Wayne Steel Foundry Co., of Ft. Wayne, Ind., has been organized with a capital of $200,000, to build a steel casting plant, containing two 20-ton acid furnaces and one 25-ton basic furnace. A Tropenas converter may also be installed.

A total of 21 furnaces for foundries; daily capacity, 650 tons, or about 200,000 tons a year.

NEW SHEET MILLS.

Sheet mills projected and under erection are as follows:

The Sharon Sheet Steel Co., one of the subsidiary companies of the Sharon Steel Co., is erecting a sheet mill to contain ten 28-inch hot and six 22-inch cold mills; ten sheet furnaces, ten pair furnaces and four annealing furnaces. A galvanizing plant will be connected with the works. The annual capacity will be 30,000 tons. Plant will probably be completed this year.

The Rolling Mill Co. of America, formerly of Connellsville, Pa., now of Morgantown, W. Va., has decided to erect a ten-mill sheet plant to contain ten hot mills and six cold mills together with sheet furnaces, pair furnaces and annealing ovens. The plant will not be in operation this year. Annual output about 30,000 tons.

The Colorado Fuel & Iron Co., Denver, Col., is installing an 8-mill sheet plant. The annual output is estimated at 24,000 tons.

The Stark Rolling Mill Co., Canton, O., is adding two additional hot mills. To be completed this year.

The Louisville Bolt & Iron Co., Louisville, Ky., is adding a 26-inch sheet train to contain two hot mills and one cold mill. To be completed this year.

The Wheeling Roofing & Cornice Co. is adding one sheet mill to its equipment. To be completed this year.

The West Carnegie Sheet Steel Co. is erecting a mill to contain four hot mills and two cold mills. Will not be in operation this year. Annaul capacity is estimated at 12,000 tons. The main office of the company is in Pittsburg and the plant will be erected at West Carnegie, Pa.

The Empire Iron & Steel Co., Niles, O., is erecting a plant to contain four hot mills, two cold mills, a roofing plant and a galvanizing department. The annual capacity of the plant will be 12,000 tons. The plant will probably be placed in operation this year.

The Ashland Sheet Mill Co., Ashland, Ky., is just completing and has in partial operation a sheet plant containing 8 hot mills and four cold mills with an annual capacity of 25,000 tons. The plant also contains 8 sheet furnaces, 8 pair furnaces and 4 annealing furnaces. A galvanizing plant is also connected with the works. The entire plant will shortly be in operation.

The Whitaker Iron Co., Wheeling, W. Va., is adding three additional hot mills to its plant, making a total of 11 sheet mills. It is probable that the new mills will be placed in operation this year.

The American Sheet Steel Co. is adding two hot mills at its Falcon plant, Niles, O.; four hot mills to its plant at Wellsville, W. Va., and three mills to the W. DeWees Wood plant at McKeesport, Pa. These will be in operation this year.

The Tuscora Steel Co., of Newcomerstown, O., is building two additional mills which will be finished by Oct. 1, making a four-mill plant. A new galvanizing and roofing plant will be in operation by Oct. 1.

Follansbee Bros. Co. is erecting a four-mill sheet plant near Wellsburg, W. Va. Two cold mills will also be built. It is not probable that a galvanizing plant will be operated in connection with the plant. The warehouse and office of the company are at Pittsburg.

Additions just completed by the Muskingum Valley Steel Co., of Zanesville, O., including a new 26x40-inch hot mill and another stand of cold rolls, will increase its output of black sheets 3,000 tons a year and its output of sheet bars from billets about 9,000 tons a year. A galvanizing department with an output of 25 tons a day will be added shortly.

Independent manufacturers are adding 58 mills with an

annual capacity of 175,000 tons while the American Sheet Steel Co. is erecting 9 mills with an annual capacity of 25,000 tons.

NEW TIN PLATE PLANTS.

Tin plate mills projected and under erection:

The McKeesport Mfg. Co., McKeesport, Pa., is erecting a ten-mill plant together with a tinning house to contain 24 pots. The plant is to be completed in November. There will be ten hot mills and ten cold mills. Capacity, 40,000 boxes of tin plates a month.

Colorado Fuel & Iron Co., Denver, Co., is erecting ten hot and ten cold mills. The mills are so arranged that the plant can be doubled at any time to contain 20 hot mills and 20 cold mills.

The W. H. Griffiths Co., Waynesburg, Pa., is erecting a plant to contain five 26x32-inch hot mills and four cold mills. Six sheet and a like number of pair heating furnaces are also under erection as well as three annealing furnaces. The plant will also contain 8 Thomas & White sets for tinplate. Plant will shortly be placed in operation.

The Marietta Sheet Steel & Tin Co., Marietta, O., is erecting a plant to contain four hot mills and four cold mills. Will be completed this year.

The Atlanta Rolling Mill & Tin Plate Co., Atlanta, Ind., is erecting a plant to contain six hot mills and four cold mills. It will be placed in operation about December.

Griffiths Charcoal Iron Mills, Washington, Pa., will have two hot and two cold mills; also tinning plant containing 8 sets, 2 for tinplate and 6 for terne plates. Will shortly be in complete operation.

Pope Tin Plate Co., Pittsburg, with works at Steubenville, O. Plant is partly completed and contains 12 hot mills and five stands of cold rolls. A 14-pot tinning house will also be operated.

Follansbee Bros. Co., Pittsburg, is erecting a plant near Wellsburg, W. Va., to contain four hot mills and two cold mills. A tinning house will also be operated in connection with the plant. The dippery now located at Allegheny, Pa., will be removed to the site of the new plant shortly.

The Jackson Iron & Tin Plate Co., Clarksburg, W. Va., contemplates the construction of an additional plant of eight mills for the manufacture of black sheets for stamping purposes. Work will begin on the addition by Sept. 1.

The Juniata Steel & Iron Co., Greencastle, Ind. is erecting a tin plate plant to contain six hot mills and six cold mills. The company is considering the advisability of erecting an open-hearth plant and the installation of a bar mill of sufficient size to meet the requirements of the finishing department as well as having a large tonnage to place on the market in the form of billets and sheet bars.

Total of 59 mills nearing completion and under erection by independent interests. Annual capacity, 120,000 tons.

OTHER FINISHING PLANTS.

New Blooming and Billet Mills, Plate Mills, Rod and Wire Mills, etc.

New construction under way and projected including bar and billet mills, merchant mills, rail mills, finishing mills, puddling furnaces, rod and wire mills and miscellaneous new work:

Colorado Fuel & Iron Co., Denver, Col., has under construction one 40-inch blooming mill, one 24-inch reversing mill, one 12 and 14-inch continuous mill small merchant and hoop mills. A twin rod mill with an annual capacity of 200,000 tons of rods is also being added, and a wire plant with a capacity of 200,000 tons annually. A wire nail department to contain 280 machines is under erection with an output of 1,250,000 kegs annually. It has also been decided to erect a plate mill that will roll plates 72 inches wide and from 1¼ inches down.

Clairton Steel Co., Clairton, Pa., is building a 40-inch blooming mill, and a roughing mill is under contemplation, the size of which has not been definitely decided. A 300-ton mixer is also building in the steel department. A cold rolling department is under construction and in the wire drawing department there will be installed 250 wire drawing blocks. Annealing and tempering departments are also included.

Pittsburg Steel Co., Pittsburg, is just completing the erection at Monessen, Pa., of a wire and rod mill. The plant is equipped with 3 continuous heating furnaces, 2 annealing furnaces, and a complete semi-continuous rod mill consisting of one 16-inch, one 14-inch and three 12-inch trains and is equipped for rolling billets direct into rods. Annual capacity 130,000 tons. The wire drawing department contains 160 wire drawing blocks with an annual capacity of 112,000 tons and the wire nail department contains 175 wire nail machines with an annual capacity of 1,250,000 kegs. A galvanizing department with a capacity of 45,000 tons annually is also under erection, and the barb wire and field fencing departments with an annual capacity of 27,000 tons are in operation at the present time.

Ohio Falls Iron Co., New Albany, Ind., is adding a 20-inch three high muck mill, 60-inch squeezer, one 5-ton steam hammer, one 12-inch guide mill with 16-inch Belgian roughing train. Also nine large scrap furnaces. Additions will be placed in operation this year.

Griffiths Charcoal Iron Mills, Washington, Pa., are erecting 6 single puddling furnaces, a forge containing 8-knobbling fires and two 6,000 pound hammers. Will be in operation this year.

The Clearfield Steel & Iron Co., of Pittsburg, will erect a plant at Clearfield, Pa., to contain 24 puddling furnaces, 18-inch bar mill, 9-inch guide mill, 52-inch squeezer and a train of rolls to roll rails up to about 30 pounds. Plant will not be in operation until next year.

Ohio Steel & Iron Specialty Co., Cuyahoga Falls, O., will erect a mill to roll small ignots into finished bars.

The Jones & Laughlin Steel Co., Pittsburg, is adding a 40-inch blooming mill with an annual capacity of 300,000 tons of blooms and billets.

The United Steel Co., Canton, O., is installing a 34-inch universal mill that will take 18x20-inch ingots and break them down into plate and sheet bars. A four-hole soaking pit is also being built. The entire plant will be commanded by a Morgan 50-ton ladle crane and a Morgan 10-ton ingot crane.

The Sharon Steel Hoop Co., Sharon, Pa., is installing a 24-inch, three-high blooming mill that will break down ingots to 3-inch billets. A 12-inch billet mill is also being built that will break down billets from 3 inches to 1¼ inches. It will also roll flats from 6 to 3 inches. Two regenerative heating furnaces are under erection.

The Franklin Rolling Mill & Foundry Co., Franklin, Pa., is building a mill to roll shapes from which trolley poles are made. There will be three stands of three-high 18-inch rolls.

While it is rumored that the John A. Roebling's Sons Co., Trenton, N. J., contemplates the erection of an open-hearth plant together with a large wire mill, no definite information can be secured. The building of a plant in the St. Louis district is under consideration.

The Hollidaysburg Iron & Nail Co., Hollidaysburg, Pa., is planning to build a finishing department to contain a bar and guide mill and a nail plate mill together with four heating furnaces. A rail mill will also be built to roll light rails up to 40 pounds to the yard.

The Norwalk Steel & Iron Co., Norwalk, O., has under erection two 38-inch crucible floors, equipped with 95 pots and two merchant mills. Eight steam hammers are also being installed.

Alan Wood Iron & Steel Co., Conshohocken, Pa., is erecting a billet and slabbing mill to roll bars for the Alan Wood sheet plant. The open-hearth department will turn out sufficient steel for the sheet department and there will be a surplus of about 100,000 tons annually.

Wickwire Bros., Cortland, N. Y., are building a blooming mill and a billet mill.

Columbia Bridge Co., of Pittsburg, is installing a merchant mill at its plant, Carnegie, Pa., to roll rounds up to seven inches; also a structural mill for rolling angles and small shapes.

The Burden Iron Co., Troy, N. Y., is adding two regenerative heating furnaces.

Henry Disston & Sons, Philadelphia, are adding two continuous billet heating furnaces.

The Baltimore Rolling Mill Co., Baltimore, Md., is erect-

ing a plant to contain a train of 10-inch and 18-inch rolls. There will be no puddling or steel department in connection with the finishing mills.

The Lukens Iron & Steel Co., Coatesville, Pa., is adding a large plate mill, three high, with rolls 140 inches long and 38 inches diameter. Capacity, 100,000 tons a year, making the company's total annual capacity in plates, 275,000 tons.

The Susquehanna Iron & Steel Co., Columbia, Pa., is erecting a wrought pipe plant to contain one lap-weld mill to roll pipe from 2 to 10 inches, also a butt-weld mill to roll from ⅛ to 2 inches. There will be eight water seal gas producers and a threading shop is being erected.

The Deering Harvester Co., Chicago, has had plans prepared for the erection of a plant to contain 8, 9, 12 and 16-inch merchant mills, 22, 26 and 28-inch plate mills and a 32-inch blooming mill. This will not be completed until well into 1903.

The Louisville Bolt & Iron Co., Louisville, Ky., is installing a 20-inch train for rolling sheet bars and a 48-inch squeezer.

The Wheeling Roofing & Cornice Co., Wheeling, W. Va., is erecting a tinning department to contain 8 pots; also a galvanizing department.

The Cambria Steel Co., Johnstown, Pa., has under erection a 134-inch plate mill, which will be in operation in October.

The Southern Rolling Mill Co., is building a plant near Ensley, Ala., to contain a 10-inch guide mill, backed by a roughing mill. There will also be a continuous heating furnace in the plant. Steel billets will be rolled to merchantable shapes.

The Carnegie Steel Co is installing a 38-inch blooming mill at its Homestead plant, Homestead, Pa. A new angle mill has been decided upon but work has not yet begun.

The Elmira Rolling Mill Co., Elmira N. Y., is installing 10, 14 and 18-inch merchant mills. There is no puddling department under consideration or erection.

The Rolling Mill Co. of America will install a blooming mill and a bar mill in its new plant at Morgantown, W. Va.

The Empire Iron & Steel Co., Niles, O., is installing a sheet bar mill in its new plant.

The Harrisburg Pipe & Pipe Bending Co. is building a blooming mill and a skelp mill in connection with the new open-hearth plant under erection.

The Sharon Steel Co., Sharon, Pa., will shortly place in operation one 30-inch universal mill and three 26-inch bull-head trains for the manufacture of steel skelp. The plant for the manufacture of wrought steel pipe is also nearing completion and butt-weld pipe from ⅛ to 2 inches and lap-weld from 2 to 14 inches will be produced.

The Vulcan Crucible Co., of Pittsburg, is adding two annealing ovens and a train of 10x14 inch rolls to its plant at Aliquippa, Pa.

The Republic Iron & Steel Co., Chicago, is replacing its 12-inch mill at the Brown-Bonnell plant, Youngstown, O., with a continuous mill. The 8 and 10-inch hoop mills in this plant are also to be reconstructed. Three roughing trains are being added to supply the material for the new merchant mills. In addition automatic straightening and cooling beds are being put in, five Morgan gas producers with automatic feeds and three Morgan suspended roof billet heating furnaces. At the Bessemer plant, Youngstown, O., the blooming mill will be replaced by a 40-inch mill and the 5-ton converters are to be replaced by 10-ton vessels, and an additional converter will be added. New soaking pits are to be built and an additional stripper. The plant at Springfield, Ill., is being practically rebuilt; a new muck mill is being installed as well as 9, 16 and 22-inch mills. The plant will be placed in operation in September or October.

The West Carnegie Sheet Steel Co., West Carnegie, Pa., will install a bar mill in its plant to break down ingots to sheet bars.

In addition to the rebuilding of its Bessemer rail mill at West Seneca, N. Y., the Lackawanna Steel Co. will build plate and structural mills of capacity not yet given out. These will probably be operated in 1903.

The Knoxville Iron Co. is now consolidating its Knoxville and Harriman plants at Knoxville, Tenn., where operations will begin in the new plant in the early part of October. A large amount of new equipment is being added, and on its completion the plant will have a capacity of 50,000 tons a year of bar iron.

The Jessop Steel Co.'s sheet rolling mill at Washington, Pa., will contain 6 regenerative heating furnaces, 2 annealing furnaces, 2 forge fires and 2 trains of rolls. Annual capacity about 10,000 gross tons of crucible steel sheets and band saw steel. In the crucible department will be 3 steel melting furnaces. In operation Oct. 1, 1902.

At the Union Steel Co.'s plant Donora, Pa., another Garrett finishing rod mill will be put in operation late in August.

Worth Bros. Co., Coatesville, Pa., is building a modern plate mill with 100,000 tons annual capacity, to be ready for operation in the early part of next year.

The Parkersburg Iron & Steel Co., Parkersburg, W. Va., which now has five sheet mills in operation, is completing a bar mill to supply its sheet plant. The bar mill will be in operation in the next two weeks and will have an output of 60 tons a turn.

TIN PLATE PROPOSAL REJECTED.

Late advices are that the vote on the acceptance of a 25 percent reduction by the tin plate workers affiliated with the Amalgamated Association of Iron, Steel and Tin Workers, on all tin plate rolled to take the place of that now imported with a rebate allowance, has been practically defeated, although a number of important lodges have not yet voted. The vote is not a lodge vote but a per capita vote and the large lodges have voted against the proposition by overwhelming majorities. It is reported that the lodges not heard from will vote on Saturday and there is every indication that the majority against the proposition will be still further increased. By this action the men refuse to permit the American Tin Plate Co. to receive orders for tin plate, amounting to fully 1,500,000 boxes annually, which is now rolled in the Welsh tin mills and is imported into this country under the rebate feature of the present tariff.

The men employed in the independent tin mills were practically a unit against the proposition. Many of the independent tin mill owners were under the impression that they could not secure any of this rebate business. The American Tin Plate Co. cannot keep all its mills in operation without this trade and notices have already been posted at the Anderson, Ind., plant of the company that it will close down the latter part of this week for an indefinite period. The plant at New Kensington, Pa., is also reported closed.

Iron Molders' Union.

At last Friday's session of the Iron Molders' Union of North America, at Toronto, Ont., President Martin Fox, of Covington, Ky.; Vice President Joseph F. Valentine, of San Francisco; Second Vice President M. J. Keough, of Troy, N. Y., and Third Vice President J. Frey, Worcester, Mass., were all re-elected. Philadelphia was selected as the next place of meeting. The election of the old officers was expected and indicates an endorsement of the conservative policy of the present administration. In line with this action was that of the convention on various resolutions introduced. The proposal to allow local unions to strike without authority from the executive board was voted down. It is reported also that the proposal to abrogate the New York Agreement now existing with the National Founders' Association was defeated.

A. Falkenau and the Philadelphia Machine Tool Co., of Philadelphia, announce that they have formed a new company, which has taken over the plants and business of both, and will be known as the Falkenau-Sinclair Machine Co. Its offices and plant are at 109-115 North 22d St., Philadelphia. Increased facilities have been provided for building high grade machine tools and special machines. Contracting for machines in quantities will have special attention and the full lines of presses and machines for working sheet metals, hydraulic machinery and testing machines will be continued and extended.

The Cleveland Crane & Car Co., of Cleveland, has moved its plant to its new location at Wickliffe, near Cleveland.

PERSONAL.

James Duncan, president of the Duncan Bros.' Foundry, Alton, Ill., has been chosen president of the Litchfield & Madison Railroad, which is a branch of the C. P. & St. Louis Road.

Charles L. Nelson has been appointed manager of the Pittsburg office of the Cleveland Pneumatic Tool Co. with headquarters at 411 Park Building. The Cleveland tools are used extensively in the Pittsburg district.

W. A. Dinker, purchasing agent of the Pittsburg Coal Co., Pittsburg, Pa., has resigned and has been succeeded by F. E. Now, of Cleveland. O. F. Simonds, superintendent of motive power has also resigned and has been succeeded by F. H. Stark, formerly connected with the Baltimore & Ohio railroad.

John Warner, general manager; S. B. Ely, chief engineer, and Jacob Waddell, associated with Mr. Warner, of the American Sheet Steel Co., inspected the company's plant at Struthers, O., last week with a view to making improvements.

W. J. Olcott, who has been superintendent of Mesabi range mines for the United States Steel Corporation, has been made manager of mines for the corporation, his duties covering all ranges.

President C. M. Schwab was taken ill at Atlantic City, Saturday, July 26, and naturally wide publicity was given to the fact, the pressure of responsibilities being credited with his indisposition. He was better on Monday and expected to return to New York after the rest of a few days enjoined by his physicians.

James Kennedy, of Youngstown, O., a brother of Julian, Walter and Hugh Kennedy, who are widely known in iron and steel circles, has been nominated by the Republicans of the eighteenth Ohio district as their candidate for Congress. This is the old McKinley district.

Julian Kennedy, of Pittsburg, and Axel Sahlin, of Millom, Cumberland, Eng., manager of the blast furnaces of the Millom & Askam Iron Co., have arranged to form a partnership and to open offices in London as consulting engineers for iron and steel works. Mr. Sahlin was in the United States last year as a member of the British Iron Trade Association's Commission on the American iron and steel industry, and wrote the report on American blast furnace practice recently reviewed in these columns.

P. A. Kilner, of Chicago, who was in charge of the plant of the York (Neb.) Foundry & Engine Co. from 1888 to 1895, has become manager of the Downie-Wright Manufacturing Co., of York, Neb., manufacturers of grain elevators, mill and mining machinery.

The Liggett Spring & Axle Co. will move its plant from River Ave., Allegheny, to a tract of 150 acres on the Monongahela River in Forward Township, Allegheny County. The Coshocton Iron Co., which is to engage in foundry work as an affiliated concern of the Liggett company, will also locate there. The initial industrial investment will be about $500,000, aside from what will be expended on the development of the tract as a new industrial community. The contract has been placed with the McClintic-Marshall Construction Co. for the erection of new steel buildings for the Liggett company. The main building will be 600 feet long. For its enlarged operations the Liggett company has increased its capitalization to $300,000. The Coshocton Iron Co. will start with a capitalization of $75,000. It will supply all the necessary castings.

Owing to delays in securing material the new plant of the Griffiths Charcoal Iron Mills, Waynesburg, Pa., will not commence operation before the middle of August or the first of September.

The Lackawanna Steel Co. has let the contract for an immense ore dock to be built on the banks of its canal at West Seneca, near Buffalo, where the steel plant is being constructed. The contract involves $800,000. The dock is to be built wholly of concrete and will be re-enforced by iron lathing. It will be ¾ mile in length and 280 feet wide, and is to be finished in seven months.

PROGRESS OF AMERICAN SHIPPING.

The Blue Book of American Shipping, a marine directory of the United States, published by the Marine Review Publishing Co., of Cleveland, will say in the volume for 1902, to be issued in a few days:

"Since the last issue of the Blue Book of American Shipping the country has experienced a period of prosperity to the point of congestion. The country has, indeed, had more business to do than it could reasonably attend to and the inevitable consequence has been that delivery in manufactured lines has been delayed. Iron is the base of the industrial life of this nation, and the demand for iron has steadily exceeded the capacity of the furnaces to produce it. The capacity of mills has also been unequal to the demand, and in nearly all lines of steel manufacture order books are practically filled for the first half of 1903. Owing in part to the scarcity of the stuff out of which ships are made there has been, to some extent, a lessening of orders for new ships over last year. We say to some extent advisedly, because while the number of new orders has been limited in the seaboard yards, the builders of the great lakes have secured about all the new work they can care for until the autumn of 1903. The failure of the shipping bill leaves the seaboard yards with little hope of more ships to be built for the foreign trade, and some orders for new vessels for the coasting trade are undoubtedly withheld on account of the higher prices demanded for ship material. However, the break has already come in Britain where a ship may be built today for 30 percent less than it could have been built a year ago."

The number of vessels built in the United States in the year ended June 30, 1902 (nearly all for coasting trade, of course, and a very large part of them on the great lakes) was 1,657 of 473,981 gross tons, compared with 1,709 vessels of 489,616 tons for the preceding year. The decline during the year is in sailing vessels, canal boats and barges. This year the sailing tonnage aggregated 101,072 tons; last year, 128,099 tons. A substantial increase is noted in steel steamers, which aggregate 275,479 tons, as against 235,265 tons for last year. The construction of canal boats and barges declined from 88,331 tons to 57,502 tons.

The stockholders of the Paterson Iron & Steel Co., Paterson, N. J., have been restrained from dissolving by the Merchants' Trust Co., of New York, and James G. Shields of the same place. The company's plant was recently destroyed by fire.

The new plant of the Morgantown Foundry & Machine Co., Morgantown, W. Va., was placed in operation this week.

The Colorado Fuel & Iron Co., Denver, Col., has purchased a reservoir site of 2,000 acres in Lake Park, Lake County, Col., which will be used for reservoir purposes. When dammed the property will hold about 7,500,000,000 gallons of water and it will supplement the company's present water supply for its various plants.

Bulletin No. 3 of the University of Texas Mineral Survey deals with coals, lignites and asphalt rocks, and forms the third in a series of economic publications relating to the mineral resources of the State. The report extends to 137 pages, is well illustrated with maps, diagrams of geological formations and a number of half-tones. The composition and relative value of the various coals and lignites for fuel purposes are discussed and the composition and occurrence of the asphalt rocks has also received an extended investigation. The different deposits in the State are described and many analyses have been made. The work is well indexed, and is a useful contribution to the literature of a subject now attracting no little attention at home and abroad. The preparation of the report has been in charge of Dr. Wm. B. Phillips, professor of field and economic geology and director of the survey.

The B. & O. Railroad has ordered 40,000 tons of rails to be used in maintenance work next year. One-half of the contract went to the United States Steel Corporation and the other half to independent mills, including the Maryland Steel Co. and Cambria Steel Co.

Pig Iron Production, First Half of 1902.

The American Iron and Steel Association has collected from manufacturers and published complete statistics of the production of all kinds of pig iron in the United States in the first half of 1902; also complete statistics of the stocks of pig iron on hand and for sale on June 30, 1902. The production of pig iron in the first half of 1902 was 8,808,574 gross tons, against 7,674,613 tons in the first half of 1901 and 8,203,741 tons in the second half of 1901. The increase in production in the first half of 1902 over the second half of 1901 was 604,833 tons. The united production of the second half of 1901 and the first half of 1902 amounted to 17,012,315 tons. General Manager Swank says that it is possible that the production of the whole year 1902, notwithstanding the interruption to furnace activity caused by the anthracite strike, may exceed 18,000,000 tons. In 1901 the total production was 15,878,354 tons. The production of pig iron by the United States in the first half of 1902 was in round figures a million tons greater than the production of either Great Britain or Germany in the whole year 1901, the total production of these countries in that year being respectively 7,761,830 and 7,736,663 gross tons. The whole number of furnaces in blast in the United States on June 30, 1902, was 286, against 266 on December 31, 1901, and 259 on June 30, 1901. The number idle on June 30, 1902, was 125. The table below shows the number of active furnaces and the production in each State in the last half year:

TOTAL PRODUCTION OF PIG IRON

States.	Blast Furnaces.				Production. Gross tons of 2,240 lbs. (Includes Spiegeleisen.)		
	In Blast Dec. 31, 1901.	June 30, 1902.			First Half of 1901.	Second Half of 1901.	First Half of 1902.
		In.	Out.	Total			
Massachusetts	1	.....	3	3	1,952	1 434	1,716
Connecticut	2	2	2	4	4,621	3,821	5,278
New York	7	9	11	20	109,317	174,345	186,523
New Jersey	6	6	5	11	65 524	90,232	105,295
Pennsylvania	111	109	40	149	3,549 148	3,794,109	4,045 965
Maryland	4	4	2	20	157.628	145 558	148,619
Virginia	14	16	.0	6	217,819	230,843	263,233
North Carolina	.....	.....	2	2	15,547	11,786	12,401
Georgia	1	2	3	5			
Alabama	29	31	16	47	627,214	597,998	700.546
Texas	.....	.....	4	4	1,320	953	1,528
West Virginia	3	3	.....	3	74.630	91,967	93,297
Kentucky	4	6	2	8	26,361	42,101	5 ,089
Tennessee	12	15	7	22	178,244	158,895	187,359
Ohio	45	46	13	59	1,198,850	1,727,575	1,775.490
Illinois	15	19	1	20	739,409	857,441	878,800
Michigan	5	6	2	8	93,981	76,781	85,661
Wisconsin	2	6	.....	6	124,273	83,278	131,531
Minnesota	.....	.....	1	1			
Missouri	1	2	.....	2			
Colorado	3	3	.....	3	88,775	114.634	133,237
Oregon	.....	.....	1	1			
Washington	1	1	.....	1			
Total	266	286	125	411	7 674,613	8,203.741	8,8 8,574

The production of charcoal pig iron in the first half of 1902 was 186,098 gross tons, against 194,231 tons in the first half of 1901 and 165,916 tons in the second half of 1901. In addition there were produced in Tennessee in the first six months of this year 6,004 tons of pig iron with mixed charcoal and coke.

The production of spiegeleisen and ferromanganese in the first half of 1902 was 118,982 gross tons, against 135,920 tons in the first half of 1901 and 155,541 tons in the second half of 1901.

Production according to fuel in the half year and the two preceding half years, and unsold stocks on June 30, 1902, Dec. 31, 1901, and June 30, 1901, are shown in the table below:

UNSOLD STOCKS AND PRODUCTION ACCORDING TO FUEL.

Fuel.	Stocks Unsold. Gross tons of 2,240 lbs.				Production Gross tons of 2,240 lbs. (Includes Spiegeleisen).		
	Dec. 31, 1900.	June 30, 1901.	Dec. 31, 1901	June 30, 1902.	First half of 1901.	Second half of 1901.	First half of 1902.
Bitumin'us	261,407	19?,396	42,426	21 621	6,597,379	7,185,007	7,882,732
Ant. & coke	110,127	113,117	12,007	4.715	865,024	847,503	733,740
Charcoal	62,578	58,083	15 9?0	3,425	194,231	165,916	186,098
Charcoal and coke	8,258	3,964	164	.....	17,979	5,315	6,004
Total	442,370	372,560	70,647	29,861	7,674,613	8,203,741	8,808,574

The statistics of unsold stocks do not include pig iron sold and not removed from the furnace bank, or pig iron manufactured by rolling mill owners for their own use, or pig iron in the hands of consumers. The stocks which were unsold in the hands of manufacturers or their agents on June 30, 1902, amounted to 29,861 tons, against 70,647 tons on December 31, 1901, and 372,560 tons on June 30, 1901. In addition to the 29,861 tons above mentioned the American Pig Iron Storage Warrant Co. had in its yards on June 30, 1902, 1,000 tons of pig iron, of which 800 tons were coke and 200 tons were charcoal pig iron. The manufacturers had parted with the control of this 1,000 tons. There have never before been recorded such small stocks of unsold pig iron as the figures for June 30 represent. The distribution of unsold stocks at the end of the last four half-year periods is shown below by States and in the case of Pennsylvania and Ohio by districts:

TOTAL STOCKS OF UNSOLD PIG IRON.

States.	Gross Tons of 2,240 Lbs.			
	Dec. 31, 1900.	June 30, 1901.	Dec. 31, 1901.	June 30, 1902.
Massachusetts and Conn	2,791	1,477	684	463
New York	34,260	14,930	4 907	772
New Jersey	11 500	3,150	648	241
Pennsylvania	134,995	138,921	20,750	9,279
Maryland	24 513	21,134	8,477	5,267
Virginia				
North Carolina, Ga., and Texas	8 741	4,388	1,066	.....
Alabama	49,394	95,815	4,393	5 947
Kentucky	6,673	8,067	3,156	1,589
Tennessee	15.174	11,595	1,361	1,559
Ohio	121,621	37,877	18,299	1,393
Michigan and Minnesota	32,708	35,206	6,906	3.441
Illinois and Wisconsin				
Missouri and Colorado				
Pacific States				
Total	442.370	372,560	70,647	29,861

STOCKS OF PIG IRON IN PENNSYLVANIA AND OHIO.

Pennsylvania.	Lehigh Valley	41,664	77,677	3,783	2,094
	Schuylkill Valley	21,895	17 136	4,756	1.076
	Upper Susquehanna Valley	21 102	5,090	1,409	1,182
	Lower Susquehanna Valley				
	Juniata Valley	4 815	7 978	600	3,110
	Allegheny County	1,082	1,069	.....	.....
	Shenango Valley	22,742	7 209	4,017	899
	Miscellaneous bituminous	18,003	19,674	3,139	338
Ohio.	Charcoal	3,692	3,088	3 046	589
	Mahoning Valley bitum	80,792	13,568	8,343	364
	Hocking Valley "	1,200	1,800	.....	300
	Lake Counties "	10,761	10,600	1,671	.....
	Miscellaneous "	8 250	750	.....	.....
	Hanging Rock "	16,913	9,244	5,703	389
	Hanging Rock charcoal	3.705	1,915	2,582	250

The production of Bessemer pig iron in the first half of 1902 was 5,105,932 gross tons, against 4,582,187 tons in the first half of 1901 and 5,014,606 tons in the second half of 1901. The figures for 1902 include 81,818 tons of low-phosphorus pig iron. In 1901 the production of low-phosphorus pig iron was not separately ascertained but is included with Bessemer pig iron.

The production of basic pig iron in the first half of 1902 was 1,053,274 gross tons, against 645,105 tons in the first half of 1901 and 803,745 tons in the second half of 1901. The tables below show the production of Bessemer iron in the past six months, and in the first half and second half of 1901 by States, and in Pennsylvania and Ohio by districts; also the production of basic iron in the same periods:

PRODUCTION OF BESSEMER AND LOW-PHOSPHORUS PIG IRON.

States.	Production. Gross Tons of 2,240 Lbs. (Includes Spiegeleisen).		
	First half of 1901.	Second half of 1901.	First half of 1902.
New York	12,253	16,239	17,983
New Jersey			
Pennsylvania	2,372,483	2,513.394	2,579.439
Maryland	154.082	143,067	144,750
West Virginia and North Carolina	74,630	91,967	93,297
Tennessee	.....	.....	2,855
Ohio	1,230,547	1,406,544	1,372,209
Illinois	660,614	743,816	752,989
Michigan, Wisconsin, and Minnesota	25,569	14,372	38,349
Missouri and Colorado	62,009	85,207	104,061
Total	4 582,187	5,014,606	5,105,932

PRODUCTION OF BESSEMER AND LOW-PHOSPHORUS PIG IRON IN PENNSYLVANIA AND OHIO.

Pennsylvania.	Lehigh Valley	58,211	64,979	77,386
	Schuylkill Valley	41,140	41,080	30,902
	Upper Susquehanna Valley	54,606	25,636	3,147
	Lower Susquehanna Valley	262,894	243,983	225,696
	Juniata Valley			
	Allegheny County	1,360,338	1,537,028	1,551,847
	Shenango Valley	360,374	356,441	434,597
	Miscellaneous bituminous	234,940	244,247	255,864
Ohio.	Mahoning Valley	495,708	575,340	561,965
	Hocking Valley	.....	.....	.....
	Lake Counties	340,001	409,056	344,117
	Hanging Rock bituminous	35,687	57,589	52,568
	Miscellaneous bituminous	369,151	364,559	413,559

PRODUCTION OF BASIC PIG IRON.

New York and New Jersey	6,235	28,085	50,994
Pennsylvania—Allegheny County	237,593	330,933	443,901
Pennsylvania—Other counties	198,471	244,773	304,613
Virginia and Alabama	134,598	166,846	179,974
Ohio and Missouri	68,208	33,618	73,772
Total	645,105	803,745	1,053,274

Commenting on the position of the anthracite furnaces, the *Bulletin*, from which we take the above statistics, says: "The production of pig iron in 1901 with anthracite and mixed anthracite coal and coke was 1,712,527 tons, or less than one-ninth of the total production, and of the entire anthracite and mixed anthracite coal and coke production of the year only 43,719 tons were made with anthracite alone. The production of pig iron with anthracite and mixed anthracite and coke in the first six months of 1902 amounted to 733,740 tons, against 847,503 tons in the second half of 1901, and the production with anthracite alone amounted to 15,990 tons. These figures, reinforcing those above given for 1901, and in the face of an immense total production of pig iron in the first six months of 1902, show that this country can get along without anthracite coal in its blast furnaces, although it will fare better with it. Coke is now being wholly substituted for mixed anthracite and coke in a number of furnaces which have heretofore used the mixed fuel."

LAKE SUPERIOR IRON MINES.

The Republic Iron Co., which operates the once famous Republic mine on the Marquette range and owns the steel steamer Republic, the wooden steamer Continental and the schooner Grace Holland, has received an offer for its property from a large consumer of iron ore, believed in usually well informed circles to be the Cambria Steel Co. The following letter has been sent to the stockholders of the Republic Iron Co.: "The officers of this company have been approached by a large consumer of iron ore with a suggestion that they would like to consider the purchase of all, or of not less than a controlling interest of the stock of the Republic Iron Co. The directors have had the matter under careful consideration for some time, with the result that the judgment of a majority of them favors a sale, with the opportunity for all that wish to join, provided that a price of $15 a share can be obtained. Messrs. G. W. R. Mattison, Samuel Mather, J. V. Painter, A. Hart, W. F. Dummer, N. M. Kaufman, William D. Rees, W. B. Castle, J. C. Gilchrist and Jacob Perkins, directors and stockholders of the company, whom it has been possible to consult on the subject, have signified their willingness and desire to sell the stock which they respectively own or control at the price named above. Any stockholders who may wish to dispose of their holdings of stock on this basis will please forward their certificates to the treasurer of the company, as their agent for that purpose, and whenever within the time stated below a majority of the shares shall have been sent in and received by him it is understood that he shall make a definite offer of the stock and if the offer is accepted and the stock taken, he shall remit to each stockholder the amount due him at the price obtained, not less than $15 per share ,or should no sale result, then whatever certificates shall have been so received shall be returned by the treasurer to the stockholders on or before Aug. 20, 1902."

The Cleveland-Cliffs Iron Co. has completed its new dry house at the Cliffs Shaft, Ishpeming, Mich. The buildings is of brick, 30x135 feet, and is well equipped for the comfort and convenience of the men.

The Hartford mine, owned by the Oliver Iron Co., is rapidly being put in readiness for operation. A new boiler house is being built.

The Negaunee mine, where ten men lost their lives last January in a cave-in, is now in good condition. The present output is 900 tons daily. The United States Steel Corporation's lease of the mine expires in September next year, when the property passes to the Cleveland-Cliffs Iron Co.

It is stated that Oglebay, Norton & Co., have secured an exploring option on the six forties adjoining the Aragon mine, on the Menominee range. The option was secured from Capt. Thomas J. Spencer, who has been doing some exploring on the property. Two diamond drills will be placed in operation. It is the expectation to locate a continuation of the Aragon formation.

A telegram from Duluth announces that a syndicate of Pittsburg men, headed by E. H. Jennings, has just paid $25,000 cash for the fee of lands owned by the Mesabi Central Land & Exploration Co., consisting of thirty-nine forty-acre tracts on the Mesabi range. Alfred Merritt is president of the land and exploration company. On the land is the Republic mine, a steam shovel proposition, which contains 6,000,000 tons of high grade ore. A contract has been awarded to strip 1,000,000 yards from over the ore body and the mine may enter the list of shippers late this fall or early next spring.

The holders of the option on the Arcturus mine, Mesabi range, have failed to close the deal and the $50,000 paid has been forfeited. The owners now ask $1,000,000 for the mine. The recent option was given at $750,000.

The Oliver Iron Mining Co. is said to be considering the advisability of beginning operations on three or four of its idle properties on the Cascade Range. In case work is started operations will likely be resumed at the Primrose, Star West, Richmond and Moore. The Platt is also an Oliver property, but the Donora Mining Co. is operating it under lease.

ELECTRICAL DEVELOPMENT AT THE "SOO."

Without question, one of the most active scenes of engineering development at the present time in the United States is the "Soo" district, at the point on St. Mary's River where Lake Superior empties into Lake Huron, and where two large industrial towns on the American and Canadian sides have already sprung up. The details below are given by the *Electrical World:* At this point the river has a fall of about nineteen feet at the Rapids in a distance of 3,000 feet, developing at least 175,000 horsepower. Part of this energy, hitherto wasted, has already been utilized on the Canadian side, and at the present moment two other kindred enterprises are being pushed. While the development will be in sharp contrast to that at Niagara, owing to the slight head of water at the "Soo" as compared with an average of about 200 feet at the great cataract, the two enterprises compare in magnitude and each presents unique features. For the new work at Niagara on the Canadian side, three of the largest generators in the world are being built. A contrast is presented by the plans for the "Soo," where for the new work now to be carried out, the Stanley Electric Mfg. Co., of Pittsfield, Mass., has been awarded a contract for no fewer than 40 generators, etc., the impulse wheels to drive which are already in place. The building in which these machines will be installed is itself over a quarter of a mile long and three stories in height, and the power canal which will divert water from the Rapids to the wheels has also been dug and finished, 210 feet wide, 20 feet deep and 5 miles long. This development is on the American side of Sault Ste. Marie.

The amount of power to be developed will, it is stated, approximate 100,000 horsepower, and this extraordinary plant will unquestionably be by far the largest hydro electric equipment under one roof in the world. The current will be utilized by the Clergue syndicate for the rolling mills, pulp mills, electro-chemical works and other industries of the Consolidated Lake Superior Co. and concerns of a similar character, while it is believed that a large part of the current will also be transmitted to Canada. The electrical contract is now being carried out and the apparatus will be installed forthwith. It is curious to think that the same water thus used so much higher up on the chain of lakes should again yield its energy at Niagara. The current generated will be three-phase, 30 cycles.

Judge Stevenson Burke, a resident on Euclid Ave., Cleveland, has begun suit against the Pennsylvania Railroad Co. and a number of manufacturing companies asking $50,000 damages. Judge Burke says the companies use a cheap coal of a very low grade. He says that the smoke from this coal has caused great damage to his property. He also says that he has complained to the companies, but they refused to do anything to correct the alleged evil, and continued to fill his yard with smoke and soot.

Jones & Laughlin Steel Co. Succeeds Jones & Laughlins, Ltd.

On Friday, Aug. 1, the partnership of Jones & Laughlins, Limited, of Pittsburg, Pa., will cease to exist and the properties and assets will be transferred to a corporation chartered under the laws of the State of Pennsylvania, designated the Jones & Laughlin Steel Co., having a capital of $30,000,000 book value. An issue of $10,000,000 worth of bonds has also been provided for, which may be used as seems expedient, in improvements or enlargements, or for any other purposes. The capital stock under the limited partnership, which has existed since April 1, 1900, was $20,000,000. In both cases the capitalization is considered very conservative and does not by any means represent the actual value of the properties owned and controlled. During the past three or four years numerous offers have been made the company by promoters of combinations for the sale of the properties, but all have been declined. It has been reported that as high as $100,000,000 has been offered for the combined properties.

Next to the United States Steel Corporation, this company is the largest producer of steel in the United States, and there is every indication that it will continue its operations independently as has been the case for more than half a century. None of the stock or bonds will be placed on the market at the present time, all of the stock having been taken by the present stockholders. The change has been made desirable by reason of the early expiration of the present partnership by limitations, and because of the more enduring form of organization and better facilities secured under corporate laws. No change is contemplated in the ownership or policy of the company.

The board of directors has been augmented by three additional members, namely, W. W. Willock, Robert Geddis and Henry S. Kiehl. Mr. Willock is vice president and general manager of the Monongahela Connecting Railroad Co., one of the subsidiary interests of the Jones & Laughlin Steel Co. Robert Geddis is assistant sales agent in charge of the hot roll products and Henry S. Kiehl is general agent. The board of directors of the new company consists of: B. F. Jones, H. A. Laughlin, G. M. Laughlin, James Laughlin, Jr., B. F. Jones, Jr., Willis L. King, William Larimer Jones, Thomas O'Connor Jones, Irwin B. Laughlin, J. B. Laughlin, W. C. Moreland, Roland Gerry, W. W. Willock, Robert Geddis and Henry S. Kiehl. Officers have been elected as follows: B. F. Jones, Jr., president; Willis L. King, vice president; William Larimer Jones, general manager; Irwin B. Laughlin, treasurer; T. K. Laughlin assistant treasurer; W. C. Moreland, secretary, and Wendell Van Hook, auditor. The subsidiary companies owned and controlled are as follows: Vesta Coal Co., Inter-State Iron Co., Blair Limestone Co., Ltd., Monongahela Connecting Railroad Co., Blair Supply Co., Ltd., and the Angeline Dock Co.

B. F. Jones, the founder of the company, continues as a member of the board of directors, but holds no other official position. His son, B. F. Jones, Jr., who has been elected president, is one of the youngest men ever elected to a position of such responsibility. His training, however, has well fitted him for the duties of the office, and he has been the chairman of the board of directors for more than two years past. It is probable that a board of managers and an advisory board will be appointed, to consist of a number of members of the board of directors.

Beginnings in the Early Fifties.

The foundation of this great concern was laid more than 50 years ago. Hon. B. F. Jones, while engaged in operating a line of canal boats between Pittsburg and Philadelphia in partnership with Samuel Kier—the firm name being Kier & Jones—had occasion to become acquainted with the possibilities of the iron trade in the State of Pennsylvania. In order to secure cargoes for the canal boats returning from Philadelphia and Baltimore, it often became necessary to purchase the iron from the forges then existing in Central Pennsylvania, and at Pittsburg the iron was stored and sold from warehouses. In this way return cargoes were secured and the profits realized were not always limited to the shipping tariffs by any means.

Thus when the Pennsylvania Railroad began to operate what was then considered an extremely modern road, the future of canal-boating was by no means bright, and very early in the fifties Mr. Jones purchased an iron plant located at Brownsville, Pa. After operating it for some time, he became convinced that it could be operated more economically at Pittsburg, and early in 1852 the plant was removed to its present location. He then associated with himself Bernard Lauth, a practical iron manufacturer, and the American Iron Works were established on the South Side by the firm of Jones, Lauth & Co. Two years later Mr. Lauth retired and the late James Laughlin became associated with Mr. Jones and the firm name was changed to Jones & Laughlin. From the beginning the company operated a large number of puddling furnaces and rolling mills, and early in its career blast furnaces were erected and operated under the firm name of Laughlin & Co. In 1869 Willis L. King, whose standing and experience in the iron and steel trades of this country are second only to Mr. Jones's, secured employment with the firm in a minor capacity, being then only 17 years of age. His progress was rapid. He secured an interest while still a very young man, and by his ability and grasp of affairs has ever since been one of the leading officials of the company.

From Iron to Steel.

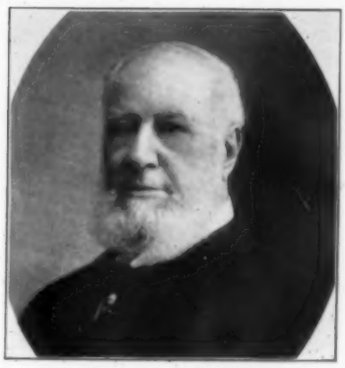
The three furnaces that were operated on the site of the present Eliza plant had a daily capacity of nearly 200 tons and all the iron was puddled and finished in the mills on the South Side, the concern having adopted the principle early in its career of finishing all the material produced. When it became apparent to American iron masters early in the eighties that the age of iron was slowly but surely passing, and that a new era, the age of steel, would take its place, it was decided to build a Bessemer steel plant, and in 1884 one 5-ton converter was installed. At this time the plant on the South Side contained 110 puddling furnaces, being then the largest iron producing plant in the country. The year preceding the installation of the converter there was another reorganization and the partnership of Jones & Laughlins, Ltd., with a capitalization of $4,000,000, was formed. This capitalization, however, did not cover the interests of Laughlin & Co., operating three blast furnaces at that time, the identity of the latter not having been lost until a very recent date.

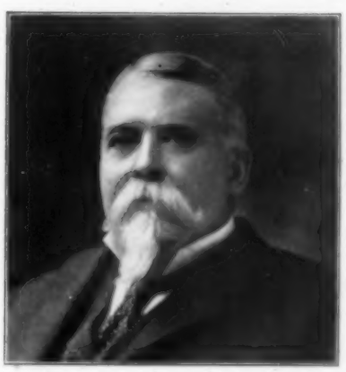
The small steel plant having proved very successful it was decided to increase the output and two years later two 10-ton vessels were installed the first blow being made on Aug. 19, 1886. As the output of steel increased the iron production diminished until today not one of the old puddling furnaces remains to mark the day of the supremacy of iron. In 1895 an open-hearth steel plant was built and in the following year enlarged. The finishing capacity kept pace with the steel producing capacity, but the firm was handicapped on account of the shortage of iron, the furnaces not being large enough to supply nearly all the metal required. About four years ago the plant of the Soho Iron and Steel Works, operated by the Moorhead-McCleane Co. was acquired by Laughlin & Co. and as the property included a blast furnace the supply of pig metal was increased. In order to bring the production of iron up to the requirements of the steel plants, and to make the concern absolutely independent of the pig iron market it was decided in 1898 to entirely rebuild the Eliza plant operated by Laughlin & Co. Three new furnaces were built and the most modern of the four furnaces was rebuilt and enlarged. The three old furnaces were entirely dismantled. On April 1, 1900, Jones & Laughlins, Ltd., purchased the properties of Laughlin & Co., then capitalized at $900,000 and the capital stock was increased to $20,000,000. As the output of the plant increased the holdings of ore and coal properties were also increased and works for coking coal were also built, until today the company is an "integrated" one, being dependent upon the market for practically none of its raw material.

A List of the Properties.

The following properties are owned and operated: Eliza Furnace plant, containing four stacks, each 100x22 feet with a total annual capacity of 790,000 tons. Soho Furnace, one stack, 80x19 feet with an annual capacity of 100,000 tons. This furnace is out of blast at present undergoing repairs, and will

OFFICERS AND DIRECTORS OF THE JONES & LAUGHLIN STEEL CO.





James B. Laughlin.
W. C. Moreland.

B. F. Jones, Jr.
B. F. Jones.
Willis L. King.
Wm. Larimer Jones.

Maj. Geo. M. Laughlin.
Thomas O'C. Jones.

Roland Gerry.
Irwin B. Laughlin.

not be placed in operation again for several months.

The South Side Works contain two 10-ton Bessemer converters with an annual output of 600,000 tons; six 40-ton basic furnaces and one 25-ton acid furnace with a total annual capacity of 150,000 tons; one Talbot open-hearth furnace with an annual output of 150,000 tons. In addition the plant contains 26 heating furnaces, 21 trains of rolls and three hammers. The three blooming mills in the plant have a daily output of about 2,500 tons, but the smaller of these mills is being replaced by a 40-inch mill which will have a daily capacity of 2,500 tons.

The Soho Department contains two 25-ton acid open-hearth furnaces and two 15-ton furnaces together with three trains of rolls, including one train capable of rolling plates 12 inches thick, 7 feet wide and 15 tons in weight and one hammer. The equipment also includes one single and two double heating furnaces, three annealing furnaces, two Siemens regenerative furnaces and ten Siemens regenerative pit furnaces.

In connection with the South Side plant there is a spike, rivet and bolt factory for the manufacture of steel structural and tank rivets, railroad and boat spikes and bolts with an annual capacity of 8,000 tons. The operation of the rod mill has been discontinued and the mills are being used at present for rolling merchant bars. While in operation the annual output of this mill amounted to 100,000 tons. The structural material fitting shops have an annual capacity of 24,000 tons, and while the fabricating is done the work of erection is not undertaken.

The chain factory with a capacity of 10,000 tons annually produces all sizes of iron and steel chains, while the cold rolling and shafting department is the largest in the country, with an annual output of 50,000 tons. The forge shop has an annual output of 3,000 tons. Two iron foundries and one steel foundry are also operated, the former with an annual capacity of 17,500 tons and the latter with an output of 2,500 tons. They cast almost exclusively large pulleys, sheaves, balance wheels, couplings, hangers, etc. The machine shops are equipped with tools of modern design and can produce pulleys and balance wheels up to 30 feet in diameter and handle masses weighing 50 tons. They are designed for turning out in large quantities, transmission machinery of all kinds, including couplings, hangers, pillow blocks, pulleys, sheaves, balance wheels, belt tighteners, guide pulleys, binder frames and other special devices.

The product of the mills consists of steel bars, light rails, plates, sheets, structural shapes, billets railroad splice bars and all kinds of merchant shapes. The annual output of finished rolled material amounts to 725,000 tons, although this is to be materially increased during the next twelve or eighteen months.

The ore properties owned and leased are located on the Mesabi and Marquette ranges of the Lake Superior region, and their output is sufficiently large to provide the present furnace capacity with raw material. About 6,000 acres of coal land in Washington County together with 1,100 acres in Fayette County are owned and the output of the workings supply all the fuel required for the plants and coke ovens. At present 141 ovens are operated in Fayette County, Pa., and 840 in Pittsburg. There are 246 additional ovens under construction at the latter place. The limestone is provided by the Blair Limestone Co., Ltd., Hollidaysburg, Pa., the capital stock of which is owned by the company. The Monongahela Connecting Railroad is also controlled by the company and a hot-metal bridge across the Monongahela river is also one of the properties.

Within the past few months a new Talbot open-hearth furnace with a daily capacity of 400 tons was placed in operation at the South Side plant, as well as two 25-ton acid open-hearth furnaces at the Soho plant. The 40-inch blooming mill under erection on the South Side will greatly increase the capacity of that plant, the mill having an output of 2,500 tons a day. As it will replace a mill having an output of 600 tons daily, the new mill, together with the two old blooming mills, will make a daily output of nearly 4,500 tons. The blooming mill will be provided with a billet mill and two finishing mills. On one of these mills standard section rails will in all probability be rolled while on the other mill tin plate bars and sheet bars will be produced.

In order to provide material for these mills the steel capacity will have to be greatly increased and to provide for the increased steel capacity it is probable that several additional blast furnaces will have to be built. These matters, however, have not been definitely decided upon, although they are under consideration.

PRODUCTION OF ZINC IN 1901.

In the forthcoming volume of Mineral Resources of the United States, 1901, now in press, United States Geological Survey, Mr. Charles Kirchhoff gives the maximum production in the history of the zinc industry in the United States as having been reached in 1901 with an output of 140,822 short tons, as compared with 123,886 tons in 1900, and with 129,051 tons in 1899. The largest gain in production was made by Kansas with an output of 74,240 short tons, as compared with 62,136 tons in 1900; Illinois also made a considerable gain from 38,750 short tons in 1900 to 44,896 in 1901. The average realized price for zinc in 1901 was $24.21 per short ton, as compared with $26.50 in 1900, with $38.50 in 1899, with $28.44 in 1898, and with $22.28 in 1897. A number of changes were made in the way of increase of capacity in plants already in existence, and several new plants were completed or were in process of construction during the year.

During 1901 the home consumption of spelter was very large, being estimated by Mr. Kirchhoff at 141,697 short tons, as compared with 99,400 short tons in 1900, and with 124,585 short tons in 1899. These figures show an exceptionally heavy consumption of spelter, which is reflected in the decline of exports of zinc in 1901 to 6,780,221 pounds, valued at $288,906, as compared with 44,802,577 pounds, valued at $2,217,693, in 1900, and with 13,509,316 pounds, valued at $742,521, in 1899. As heretofore, the exports went chiefly to the United Kingdom, the quantity being 5,167,274 pounds for 1901, as compared with 33,378,240 in 1900.

The year 1901 was one of fair prosperity for the zinc mining industry of Southwest Missouri and Southeast Kansas, which district maintains its position of overshadowing importance. The production of zinc ore in the Galena-Joplin district in 1901 was 256,920 short tons, valued at $6,318,249, as compared with 244,629 short tons, valued at $6,583,944, in 1900—an increase for 1901 in quantity of 12,291 short tons, but a decrease in value of $265,695.

The imports of zinc in 1901 amounted to 76,059, as compared with $128,090 in 1900, and with $165,667 in 1899. The world's production of zinc in 1901 is estimated at 501,494 long tons, as compared with 470,937 long tons in 1900, and with 481,854 long tons in 1899. The United States furnished in 1901 25.1 percent of the world's production, 23.5 percent in 1900, and 23.9 percent in 1899. The largest producer in the world is the Vielle Montague Co., which has the record of 72,330 long tons in 1901, as compared with 68,815 in 1900. The Lanyon Zinc Co., of Kansas, would take rank as the second largest producing company in the world, the next three largest makers being in Silesia.

Zinc White.

The production of zinc white from ores in 1901, amounted to 38,889 short tons. A new manufactory was started at West Plains, Missouri, in December, by the Renfrew Zinc Oxide Co., and the plant of the Ozark Zinc Oxide Co., at Joplin, Mo., was building, though not yet completed at the close of the year. Each of these is to have an estimated capacity of about 2,000 tons of oxide per annum.

The revised figures of the Pressed Steel Car Co. for the quarter ended June 30 compare as follows for the two years named:

	1902.	1901.	Increase
Net earnings	$934,093	$656,444	$277,640
Charges, pref. div. and depreciation	342,293	334,781	7,512
Surplus	$591,800	$321,663	$270,137

In the company's report the net earnings for 1901 were given at $511,918, charges, preferred dividend and depreciation at $230,098 and surplus at $281,820.

Liquid Fuel Combustion.*

BY CHARLES E. LUCKE, NEW YORK.

Oil combustion, considered as a rather complicated series of physical actions, has never received the attention due to its importance. There have appeared from time to time men who, taking up the corresponding question for gases, gave to the world a series of researches which leave but little to be desired, and the very perfection and elasticity of our methods of burning gases brings into stronger relief the narrow limits of present practice in oil combustion. Before we can hope to design special and proper furnaces this problem must be attacked from this standpoint, and the physical operations will when brought together and classified give us the principles of oil combustion. A detailed and minute treatment of this question would call for a lifetime of study, but some of the principles are more prominent and appear more evident than the others; a few of these have appeared in the course of some experiments undertaken for an object noted later.

The analytical treatment of the combustion of gases greatly simplifies the problem of oil combustion. By classifying the gas-burning methods according to the mode of bringing the air and gas together, it was found that there were, broadly, two great divisions of all systems, those in which a supporting atmosphere was necessary, and those in which, because of the self-propagation or explosive property of the burning mass, no supporting atmosphere was necessary. Moreover, a distinctly different set of laws of physical action holds in each case. The laws of combustion for explosive mixtures with their volumeless flames are radically different from those for all other mixtures the combustion of which calls for a supporting atmosphere, giving rise to a volume of flame due to the meeting of the fuel and oxygen at different points, and at each springing into flame when juncture is effected. The volumeless flame of the true explosive fire depends for its localization and maintenance on the relation between the rate of propogation of inflammation in the mixtures and the velocity of translation, together with the extent of freedom from diffusion of the fresh mixture with the products while approaching the combustion surface.

For a comprehension of the different cases of oil burning, we must add to our knowledge of gas combustion something on the vaporization of the oils, since it is conceded that oil will not burn as such a distillation or vaporization preceding the actual combination with oxygen. So that different oil systems will differ chiefly in the method of producing the oil vapor, and in the method of causing a meeting of this vapor with the air. Any two systems which agree in these two points must be brought together as coming under one class, but perhaps differing in details which may or may not be essential to good results.

Three Systems.

Of all the different systems proposed we can, according to the above, note only three different general classes:

1. The burning of oil in an atmosphere without previous treatment by air or heat. This class burns the oil (a) from a surface either that of the liquid mass or that of films artificially produced by sand, stones, fibrous or metal wicks. The vapor burns immediately as formed, and hence there can be no mixing with air, the flame existing merely in an atmosphere which may be often renewed or not, *i. e.*, depend on blowers or mere convection. The fires resulting from this class are grouped for action and effects with the first kind of gas combustion, a jet of gas issuing unmixed into an atmosphere of air. There may also be included (b) those retort or (c) spray vapor producers which deliver oil gas, as just noted.

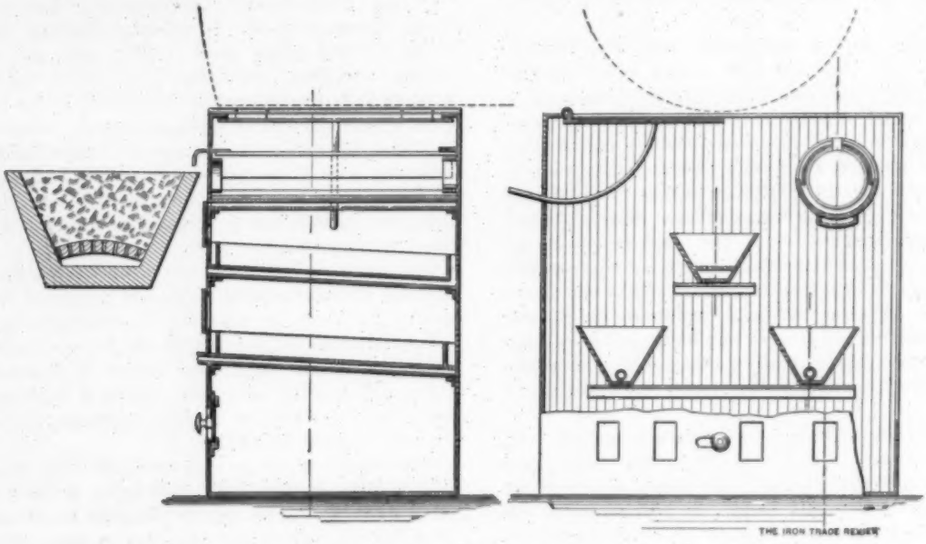


FIG. 1.—THE WEEK'S PAN WICK SYSTEM OF OIL BURNING.

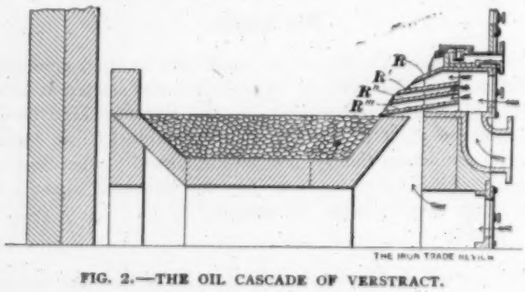


FIG. 2.—THE OIL CASCADE OF VERSTRACT.

Oil burning by methods coming under this class must be subject to the same merits and defects as the gas combustion noted, however diverse, complicated, or ingenious the details of operation or construction may be.

2. Under this class will be grouped all oil fires capable of producing what is known in gas combustion as the "Bunsen effects." That is to say, the oil is vaporized in such a way as to permit the mixture with it of a certain amount of air before it reaches the existing flame, and having reached the existing flame requires an oxygen atmosphere to support combustion. Any system producing vapor which can be handled as can a gas may also be included.

3. The third class of oil combustion will include all those methods in which the oil is vaporized and mixed with air in such proportions and in such manner that there will result an explosive mixture of oil and vapor and air. Such oil fires will be subject to the laws of combustion of explosive mixtures. The vapor may be produced in retorts by boiling a mass of liquid, or by spraying oil on hot surfaces and then conducting it to a point where it may mix with air, or the oil may vaporize by contact with or approach to a hot surface in the presence of the air.

* Read at the Boston meeting (May, 1902) of the American Society of Mechanical Engineers.

The most natural and earliest practical method of oil burning was that of simply lighting the surface of a mass resting in a pan. The amount of heat that could be developed depending on the surface of oil exposed led to a spreading of the oil over plates and running over numerous grooves and in the formation of cascades, etc. The high flash point of some oils, *i. e.*, the high temperature at which they give off combustible vapor and the presence of the liquid mass made it impossible to burn them in this way, and hence was brought about one of the first improvements in oil combustion. The wick system results from a desire to produce more vapor, and this from oils of high flash point; by it oil is caused to spread out over a large surface in as thin a film as possible, and is then subjected to heat. Being in a thin film it is easily vaporized because of the small quantity at any point and the ease with which the substance supporting the film can be heated and kept hot, the vapor thus produced burns as it appears in an air atmosphere.

When the film bearer has a low specific head the vaporization is the more rapid at the surface but slower beyond; with a metal film bearer the conduction of heat beyond the surface causes a vaporization at more points and insures more complete vaporization by a superheating at the surface; the superheating may even decompose the vapor.

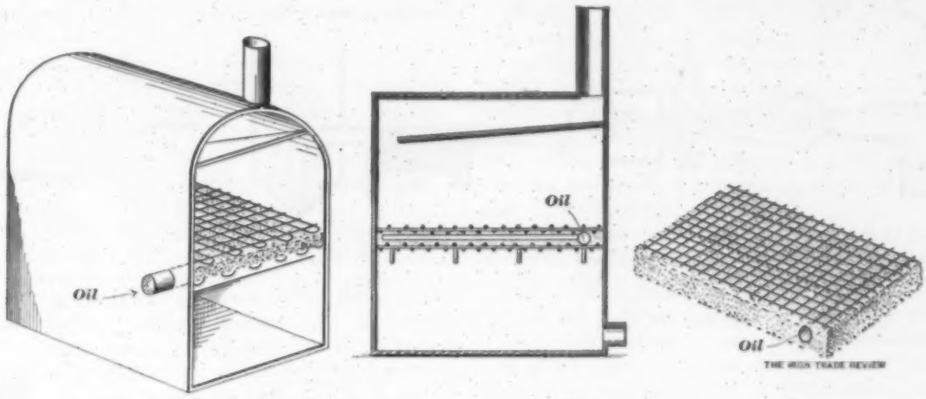


FIG. 3.—THE HUBBARD OIL BURNING SYSTEM.

Fig. 2 the cascade of Verstract, which is combined with a wick at the bottom to burn what escapes from the cascade. This is selected for illustration because it is also an example of an attempt to produce Bunsen effects in the mixing of air with the vapor. It does not succeed in this, however, because when the liquid surface is present the flame will locate there, and the air blown through the slits R on the falling oil sheet can only have the effect of an often renewed atmosphere, *i. e.*, a wind; no mixing of vapor and air is possible.

However, the surface of vaporization is increased, hence more vapor is produced, and, in addition, the air blown through helps to accelerate the combustion; but in spite of this the action is precisely the same as before, a flame of oil vapor burning in an atmosphere of air. The improvement then is not one of class but of detail.

Improvements of the same sort on the wick method, aiming to lift the wick from Class 1 to Class 2, and get Bunsen effects result in the same way. Air blown through the wick chills it and retards vaporization, in addition to slightly lifting the hot part of the surface-flame farther from the vaporization surface, which should be kept hot. An illustration of this, Fig. 3, is the method of Hubbard. A mat is provided with a pipe system to deliver oil at numerous outlets in the mass, with

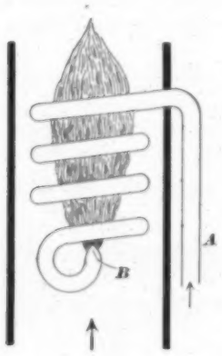


FIG. 4.

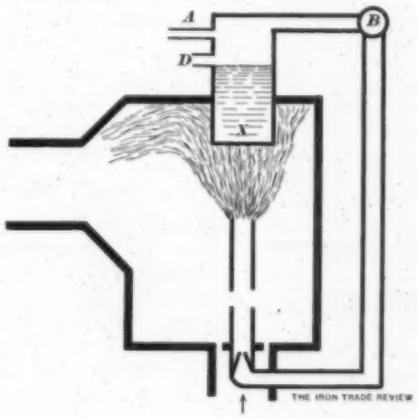


FIG. 5.

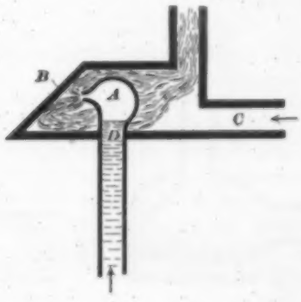


FIG. 6.

These wick burners are easily illustrated by a pile of sand, fragments of brick or fibrous material in a pan of oil; wire net may also be substituted for the fibrous or other material. For these burners to work at all the surface, at least, must be hot, and when acting in an atomsphere the latent heat of evaporation of the oil will tend to keep the temperature down, resulting in steady conditions. There will always be a limit of rapidity in such combustion, since a constant state will be reached for the wick temperature and rate of evaporation, and, consequently, for the combustion, making regulation difficult. Such systems must necessarily be slow heat producers; however perfect the combustion and disadvantages of the first class of gas combustion, we must add a few more characteristic of the methods of evaporation.

Fig. 1 shows the simple pan-wick system of Weeks, and the intention of saturating the mass. Then air is blown through the mat. The intention is to vaporize the oil in the mat by the heat from above, and the vapor, mixing with the air passing through, is to ignite on the top. It will be readily seen that as each outlet is a source of oil feed to the mat, we have a large number of wicks grouped with air blowing on them.

Supposing a vaporization to take place immediately on issuing, as is expected, and which fact, of course, depends largely on the fuel used, we will have each nozzle a source of gas, and there will result a number of gas jets blowing into the mat. The ascending air current will lift the gas jet, and there will result practically a cone of gas with apex at the orifice, surrounded by air. At the edges there would be some diffusion, and beyond the cone a moving atmosphere of air. If the mat

were thick enough and the air current not too swift, there might result an approach to a Bunsen flame in an atmosphere of air within the mat. If the mat were not thick enough, and the air current moved too fast, there would be at the surface a Bunsen effect. In no case could there be an explosive effect of Class 3, because of the relation of air and oil vapor supply, the one surrounding the other, making at every point a constantly changing proportion. Were the air and oil vapor discharged into the mat through the same orifice the effect would be quite different, as will be seen later.

Air blown on the top of a wick makes the flame a little more vigorous only because it renews the atmosphere instead of depending on convection, but the process would not change the combustion otherwise. The two systems of surface evaporation from the liquid mass and from the wick film both demand, in order that the action may be continuous and non-clogging, an easily vaporizable oil that will not distil into parts of different vaporization temperatures. With such an oil obtainable, of course the next obvious step is to simply boil it in a retort, producing vapor which can be used exactly as gas by all the means known for gases. However, an additional precaution must be taken, that of preventing decomposition of the vapor produced by undue heating before burning. This would be a great advance over the methods noted before, given only the proper fuel and we can produce any sort of fire from the illuminating flame, through Bunsen and blow-pipe effects to the more recent explosive fires with their high temperature and rate of consumption, and with each obtain perfect regulation.

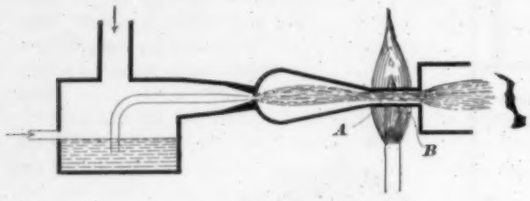


FIG. 7.

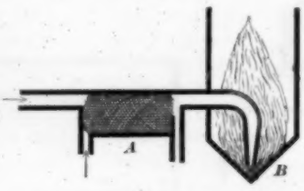


FIG. 8.

FIG. 9.

Vaporizing Oil in Retorts.

To vaporize oil in retorts requires that (a) The oil be not subject to fractional distillation, but that all of it must vaporize at the same temperature for any given pressure. (b) The temperature shall not rise above this vaporization temperature or decomposition of vapor will result with deposit of carbon to choke the passages. (c) The vapor once produced must be prevented not only from superheating before reaching the fire, but also from condensing.

These conditions are exceedingly difficult to get, and no oil cheap enough to be used for fuel in competition with coal is available for the system which is otherwise very attractive in its simplicity and range of possible effects.

These oil vapor producers may be operated by (a) the boiling of a mass of oil, (b) the vaporization of a spray, stream, or drops by contact with hot parts, and (c) by the carburated air method. The first two, so far as their resultant effects go may be grouped together, but the third has been found of value in many cases where the selection of the required fuel is not prohibited. Air is brought in contact with liquid surfaces, and passing off carries some vapor with it. We have here a mixture of air and vapor burnt in the atmosphere of air, or we may go farther and form the explosive gas requiring no atmosphere to burn. In just what proportions of air and vapor the mixture will be delivered from the carburettor depends on the temperature of the air, the intimacy and length of time of contact with the liquid, and the temperature at the evaporation surface. Of course, the temperatures of the carburettor will tend through evaporation to become continually lower, and this must be guarded against.

These oil vapor systems differ but little from the pure gas systems, and whatever can be done with gas can be done with these vapors, giving fires of classes 1, 2, and 3, provided the proper fuel is available, and, if the necessity for the fire is so urgent that cost is not the most important consideration, they may be very useful. We have not yet noted, however, any system which will enable us to burn heavy oils, or those which fractionally distil, leaving a residue and of these petroleums and some of the petroleum products form the largest and cheapest source of liquid fuel supply.

The Atomizing System.

With the spray or atomizing system we have something radically different from these so far considered, inasmuch as any kind of oil may be used and a good fire obtained with each. Here the oil passes through a small opening, where it meets air issuing at a high velocity and is by it thrown into the firebox as spray. The firebox being filled with flame and lined with brick also quite hot, each particle of oil is vaporized in the presence of air, and the products of combustion of previously consumed oil particles.

The temperature of the fire resulting is extremely high, and this led to the use of steam for the spraying agent, the injecting nozzle having other openings through which air passes under the influence of the chimney draught and partial vacuum produced by the jet. The action here is probably more nearly explosive than anything else. It was noted that the rate of propagation of combustion in explosive mixtures is very much increased by high temperatures. When an explosive mixture is forced into an enlarged chamber previously made very hot, blow-off is prevented for quite a range by this increase in the rate of propogation. The oils commonly used in the spray have a very high temperature of vaporization, and it is more than probable that, moving with the air in the hot parts of the firebox, at the high temperature of the mixture when vaporization takes place, the rate of propagation becomes so high that blow-off does not occur. However the action is not the best even though explosive, for there is a large admixture of products with the jet, particularly at the edge and at reflecting surfaces.

The entering jet, approximately conical in form, is composed of a large number of oil particles, each surrounded by

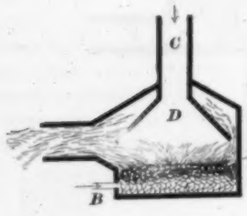


FIG. 10.

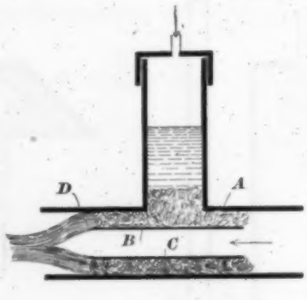


FIG. 11.

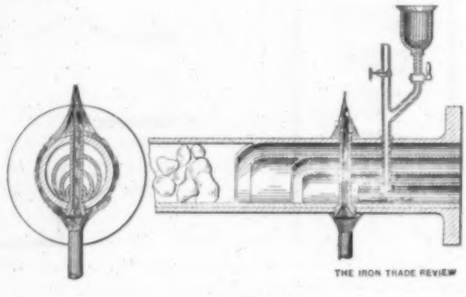


FIG. 12.

some air and some steam. As the jet approaches the hot section, the oil springs into gas and the gas with the air into flame, the steam is inactive until very high temperatures are reached, when it decomposes and acts as a cooler. The vaporization of the oil is accomplished either in space while the oil particle is in motion surrounded by air, or by contact with some of the solid surfaces of which a good many are provided in the form of arches, bridges, baffles, etc. All that can be seen is an orange glow and the course of the jet is invisible, except near the nozzle. The system requires that the spray be formed, and for this air or steam under sufficient pressure must be provided, numbers of baffles and bridges to break the current after it has entered, in order to scatter the jet and distribute the heat; a firebox of sufficient capacity to allow the formation and vaporization of spray and its final combustion; small openings at the nozzle.

Many auxiliaries to the spray have been used, but of these the most notable is that of Kermode, who sprays with heated air directed upon a bed of bricks or asbestos placed on the fire area. He provided this loose fire-bar covering simply to cover the bars easily but noted that by their presence the action was improved, for a reason which will be seen later. While most of these spray systems depend on a pressure drop of air or steam to atomize the oil and these seem to have given the best satisfaction, yet there are some others which work on the few ounces pressure of a fan. The oil is conducted to

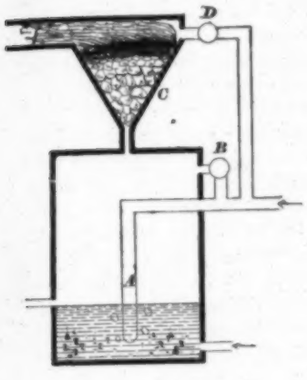


FIG. 13.

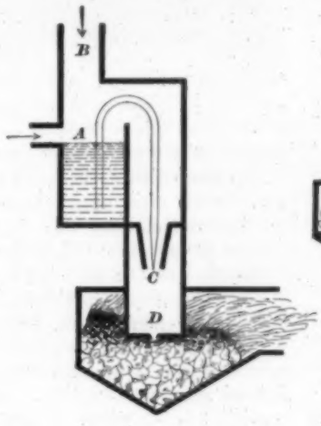


FIG. 14.

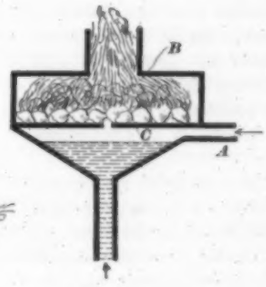


FIG. 15.

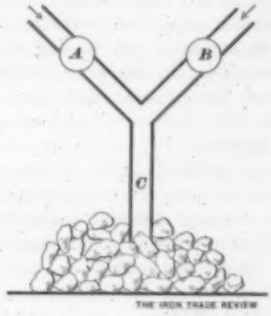


FIG. 16.

sharp points by capillary action and blown from them by the blast; tests of these generally show higher oil consumption than the compressed-air system, probably because of the lower temperature, resulting from more air and slower burning.

A System for Internal Combustion Engines.

The subject of oil combustion in general is very interesting to the laboratory experimenter, and as a system was desired which would burn enclosed under pressure for use in the internal combustion-engine, a series of experiments was undertaken at Columbia University to find, if possible, a method which was adapted to these conditions.

With the knowledge of what had been done with oil fires in other applications as a guide, the first series had for its object the determination of the principles that should govern enclosed pressure fire systems. These principles once determined, it was hoped that the desired method would appear. Some of the experiments made together with the deductions therefrom are here briefly presented for a record, as they may be of value to other workers in the field. Engines which work by passing air through a fire and thus expanding the volume at constant pressure, impose on the fire some conditions not easy to satisfy.

Air must be compressed into the firebox, and at each delivery of the compressor there will be a pressure increase on the fire; similarly at each admission to the engine cylinder there will be a pressure drop, and while we may call the system a constant pressure combustion system, this cannot be strictly true. What is constant is the mean pressure, and even this may vary after a limited time, for variation of admission and cut-off will change it. So that a fire to work successfully in this apparatus must be unaffected by pressure variation whatever may be its extent or suddenness.

One of the greatest advantages that may be derived from this type of engine over the explosive, for example, is the possibility of employing the cheap and safe heavy oils. But to realize this advantage we must add to our conditions one imposing the requirement that heavy oils shall be burnt. And finally, the products of combustion must be delivered at a constant temperature, and that as high as possible. Moreover, this maximum must be known to the designer who proportions his cylinders and mechanism for some particular volume expansion dependent on this maximum.

The most radical difference between these conditions and those imposed on an ordinary fire is that of burning, enclosed under a pressure which may vary widely and suddenly; so it was decided to first try to obtain a fire which would do this regardless of the fuel used or the delivery temperature, and this being attained to experiment with the other conditions by making appropriate modifications.

One burner which seemed to give a good steady Bunsen effect in ordinary use was that of the gasolene or kerosene soldering, torch, or cook stove. This seemed so simple and unlikely to be affected by pressures that the principle envolved was that first tried, oil fed through a self-vaporizing apparatus and escaping as gas.

Kerosene was fed through a coil of small brass tubing as shown in Fig. 4, the oil flowing from the top toward the bottom burning at B and playing on the coil. It was expected by a long coil to obtain a perfect vaporization. This device was found exceedingly irregular in action, no matter how carefully the feed was adjusted, the vapor delivery was never steady, varying from a long flame to total extinction. Matters were somewhat improved by enclosing the coil in a shell insuring a uniform heating throughout. After working for some time in this way the operation stopped, and the tube was found full of solid carbon at the lower part, showing a decomposition of vapor in that part. Gasolene, alcohol, etc., could be used, but not pertoleum and heavy oils. There were two faults prominent in this arrangement: first, the down-feed through a variously heated coil, gave rise to uneven vapor generation; second, the passage of the formed vapor through the heated part where decomposition could occur.

In the next burner it was intended to do away with both of these faults, the first to be eliminated by having a large mass of liquid boiling, and delivering vapor in such a way as to avoid superheating and so eliminate the second fault. The apparatus of Fig. 5 was made. Oil enters at A, is dropped to X, where it boils in the chamber, being heated from below; the vapor generated passes around BC, feeding the flame. B is a valve which permits shutting off vapor delivery, and by the increase of pressure also the feed which was under constant head. Any rise of oil level was prevented by the overflow D. Air entering at the bottom with the vapor a very good Bunsen effect could be produced when burning free and with naptha as fuel. When enclosed, however, and with pressure put upon the chamber the flame became very irregular, and any quick change of pressure always resulted in extinction. With kerosene there was considerable vapor condensation in the drip. Various modifications of these vapor generating pressure oil burners were tried, but all were unsatisfactory for enclosed

pressure use. The boiling oil generates within its chamber varying pressure depending on the rate of boiling, and rate of efflux of the vapor. The rate of boiling or vapor generation, if the flame below is kept constant, will depend on the pressure on the surface of the liquid.

This, in turn, depends upon the pressure on the flame and the size of opening in the vapor pipe. We thus have a number of conditions surrounding the vapor supply, from which the air supply is free, but the air supply has varying conditions of its own, and as these double conditions are never, as it were, in phase, the result is failure. The only way in which we can keep the proportions of air and vapor right is by observing the flame, and this is, of course, out of the question when it is enclosed. When conditions can be kept right, a very good fire can be made with this burner, using kerosene, gasolene, naptha, alcohol, etc.

Some other experiments leading from this brought out the fact that much better results could be obtained if the boiling is confined to the surface of the liquid rather than allowed to exist throughout the whole mass. To get this result a pipe was bent, as shown, Fig. 6, and oil fed from below to the enclosed length, which becomes hot on top from the oil vapor jet B. With a constant head, a flame could be kept lighted under pressure, and enclosed up to the feed-head. A sudden change, however, created trouble. The vapor delivery depends on the difference in pressure between the chamber and the feed-head, and the flame grows smaller, allowing the hot plate to cool when it should be getting hotter. The proportions could not be maintained at all constant under variable pressure, though the burner would work all right when proper adjustments could be made. With a feed varying with the chamber pressure a slight improvement resulted, though even then the result was not satisfactory. There was carbonization at the orifice with kerosene, and the apparatus would not work at all with heavy oil. Sudden pressure changes invariably caused extinction. The amount which can be fed economically can be varied but little, and not so as to keep any constancy of proportions with the air.

To maintain some such constancy of proportion was necessary, because the ultimate object of the oil fire was to heat the air, and different quantities of oil burnt in the same air will give different temperatures; and if the proportion cannot be predicted certainly the final temperatures cannot, and the fire is useless for the purpose in hand. With the purpose of keeping some sort of ratio between fuel and air, an air suction oil lift was tried, Fig. 7.

It was not intended that the complicated action of the common atomizing spray should result, but only that the air should lift oil in quantity somewhat in proportion to its own quantity. This oil is blown with some air through a flattened attenuated opening A, where it is spread out without changing its velocity, and then brought in contact with an externally heated plate, B, to be vaporized, the action being similar in effect to that of the carburettors used in Priestman oil engines. It was found that there was one rate of air feed at which just the right amount of oil would lift, a variation either way changing the action materially. When enclosed the slightest change of pressure results in bad action, sooting, flooding, and extinction. A number of similar injector oil lifts were made, and the conclusion reached was that none could be depended upon to produce the action desired. To further test the principle of carrying oil by the moving current of air either as mist or vapor, the arrangement of Fig. 8 was tried. Here an irregular mass of wire net fills the chamber A, which is about one-half full of oil. The wire threads draw up by capillary action the oil from the surface, spreading all over the wires and some of the spaces between, making conditions very favorable for the air to take up either mist or vapor as the case may be. The issuing jet is reflected back upon itself and heats the nozzle, insuring that any mist shall become vapor.

The opening need not be small. It worked very well for kerosene and better for gasolene, and much better for both when heated air was supplied. This fact in addition to that of liquid collecting in the cone, B, seems to indicate that a mist rather than vapor was the result of the air passage over the net. This fact is further proved by the working under kerosene without dropping of temperature such as would occur with evaporation. With a steady set of conditions this apparatus worked well as was noted, but like the injector devices, no great variation of the fire could be made. It was tried with petroleum, and the result showed a collection of residues in A, only the lighter volatile parts coming off. A little carbonization appeared at the nozzle.

All these devices depending on the vaporization of oil at some point have given great trouble from regulation when enclosed, and none was found satisfactory for variation of combustion pressure. It is probable that one could be designed, but it would necessarily be complicated. With the ones tried the temperature of the products could in no way be kept constant, and while most required large and variable excess of air, a few were found which could be operated by little; but the high temperature resulting invariably produced vapor decomposition. They required, moreover, special oils, but even this might be endured if a steady fire with always the same temperature delivery could be made to work under variable pressures; but these results could not be obtained.

The Wick Method.

The vaporization systems were now abandoned in view of these difficulties for the attractive simplicity of wick combinations which, while perhaps not offering the greatest perfection of combustion, yet would not go out when put under pressure. Fig. 9 was tried, with a bottom oil feed to the wick, and air supplied above. It was found that the wick at the bottom of the chamber was not affected by pressure, and burned steadily when enclosed, but a steady discharge was necessary, for when the discharge was interrupted the flame was extinguished. It seems as if the products must be conducted away at once, and this is probably because, with the wick, the vapor generation will go on some time after the oxygen supply fails. It also seemed advisable to have the air current and flame tend towards the same opening and not oppose. Opposition produces a violent flame and irregular action which may cease entirely at any time. To improve the means of renewing the atmosphere of this fire the burner of Fig. 10 was made. A is an asbestos mat supplied with oil from B. C is the air-supply pipe ending in the funnel D. If the oil be lighted at A, and time allowed for the whole to heat up, the burner can be enclosed and pressure applied through the air-supply C without causing extinction. The pressure in the combustion-chamber has absolutely no effect on oil flame thus produced.

The products of combustion thus produced were piped to a small Shipman steam-engine to observe the effect of the impulse of engine admission on the action of the fire. Good results for any pressure were obtained with only one drawback. If the velocity of the air over the flame be too high, the flame will go out. With gas or oil previously vaporized a surplus as well as a deficiency of air will cause extinction; here, any surplus will have no effect, provided only that it move slowly enough. A most important result was here attained, viz., the flame could be kept going under working conditions.

For a more perfect and rapid combustion of oil by the wick method, it seemed desirable to keep the flame hot even beyond its visible part, and everywhere supplied with fresh air. This could be done either by drawing the flame out to a thin sheet, or by shooting across it warm air currents, as in the blow-pipe. Accordingly, the apparatus of Figs. 11 and 12 were constructed. In A is asbestos, on top of which the oil rests, and through which oil trickles to the part below enclosed between pipe, C, and surrounding pipe, B. The flame having been started at I, air was turned on through C; the flame was conical, with a well defined blue interior, and was blue even at the tip. This method of feed might be duplicated by dropping oil in varying quantities on the loosely-packed wick if a variable combustion is desired. This burner can be enclosed and put under pressure, and, moreover, unlike the last, is not sensitive to change of velocity of air through it.

While not all the conditions desired are here met, many that are most important are fulfilled. The burner will work, enclosed, fairly steadily, and is not affected by pressure changes, but it always requires a large excess of air, and, therefore, delivers products whose temperature, though fairly constant, is yet not the maximum. Fig. 12 was made to be an advance on this type, by introducing a hot air blow-pipe effect. The flame here, instead of having a blue center, has a deep yel-

low core forced by the air currents into blue at the edges. The center is the gas generator, which gas is completely burned at the edges by air from the heated lips of the tangent tubes. External heating to redness will cause internal ignition, and wicks placed in the path of the products seem to improve the action, both in completeness of combustion and as

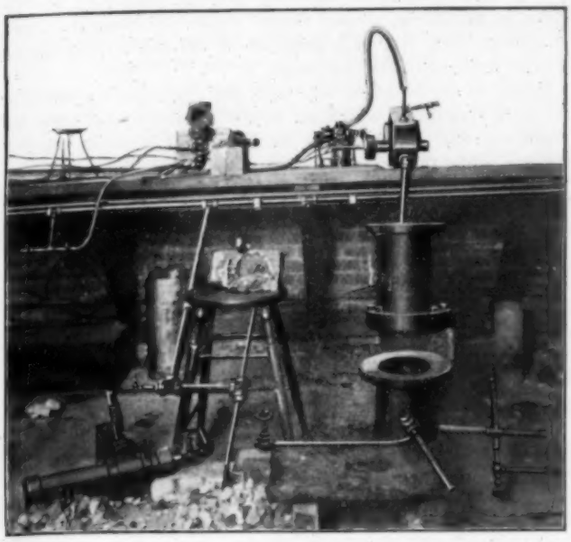


FIG. 17.

re-lighting after extinction. This burner could be used with satisfaction in every point, except that it used such large quantities of air and delivered products of comparatively low temperature.

The tendency of the preceding experiments is evident, always away from special vaporizers to arrangements with automatic regulation, the vaporization taking place in the firebox, in the presence of air if possible, and so preventing not only decomposition and carbonization, but also condensation. It seems rather odd that in general the means which worked best under the difficult conditions imposed were in general the simpliest. For the use of all oils, including those of low and those of high boiling points, probably the following conditions would, if they could be fulfilled, produce a very good oil fire: The oil to be introduced as liquid with the air and brought immediately, still with the air, to the hottest part of the fire, with means added to prevent the mixture of the vapor thus produced and its air from mixing with products of combustion of matter already burnt. At the time these conditions were formulated, it seemed impossible that any apparatus could be constructed which would permit of such action; but in fact, such an apparatus was found, and worked so well as to justify entirely all the labor of classification and minute experimental observation, which made it possible to predict what conditions should produce a good method, even when the means seemed impossible to find.

This resultant method was not the outcome of this series of experiments alone, but rather of the combined oil and gas experiments, some of which have been previously reported. Just about the time the experiments above described were completed, and the probably necessary conditions for the good oil fire formulated, the explosive gas fire described in the author's paper, No. 923, Vol. XXIII., p. 292, was discovered. By the use of the explosive mixture, a fire can be made in a closed chamber, requiring no atmosphere beyond the mixture fed, and such a fire will deliver hot gases at a constant unvarying temperature, no matter what the quantity burned; this temperature is the maximum possible, as no excess of air is heated; and, finally, this very excellent fire calls for no special apparatus, requiring simply an opening through which the feed must be made at a rate exceeding the rate of propagation, which opening is surrounded by a pile of broken rock. The function of this broken rock is to decrease the velocity of translation by increasing the area of cross-section of the advancing stream, and to increase the rate of propogation of flammation by heating until these two rates become equal, allowing the combustion to localize within the fragments.

This suggested a revival of the experiments on oil along the lines laid down as follows: It was desired to vaporize the oil and produce with the vapor an explosive mixture which, in return, was to burn under pressure as desired in one of the explosive burners. The apparatus in Fig. 13 was constructed to do this; gasolene is held in a chamber kept at about 60 degrees Fahr., and bubbles through from A, the carburetted air was rendered explosive by the manipulation of the by-pass B, admitting pure air above the liquid. The resulting explosives mixture was burnt in the explosive-burner, C. This arrangement fulfilled the requirements exactly so far as this particular fuel was concerned, giving a fire under pressure not affected by any changes in pressure however sudden, and delivering at all feeds hot product of exactly the same temperature. This burner was also piped to the steam-engine and a second by-pass, D, permitted, keeping the temperature of the air entering the engine under perfect control. Wide variations speed and pressure had no effect, neither had the pulsation due to engine admission and cut-off. Here, then, was a very encouraging result, but, unfortunately, only, the fuels easily vaporized, such as naptha, gasolene, benzine, alcohol, etc., were available.

"The Explosive Oil Fire."

The next step was an attempt to utilize kerosene in a somewhat similar way. To this end the apparatus of Fig. 14 was set up. Here oil is fed to chamber A and kept at variable level; air is admitted at B and passing C throws a spray into D where it is vaporized by the heat of the fire; the end D being covered with the rock an explosive fire resulted, the correct proportion of air to vapor being maintained by varying the air supply and oil fuel. Thus, while it worked under some circumstances and gave a very satisfactory fire, showed the same trouble that was experienced with sprays in the other series of experiments and was abandoned for the device there found to be more satisfactory, *i. e.*, a surface boiling of the liquid.

Fig. 15 shows the device constructed for this purpose. Air was admitted at A, and with it, at first, some gas, making an explosive fire at B. The oil was fed from below to the cone under the plate, C, heated from above. Varying level exposed more or less surface to be heated and varied the dis-

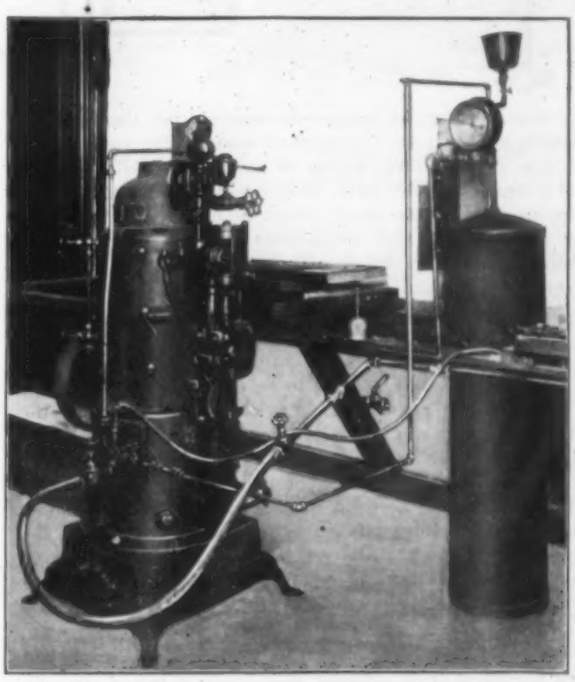


FIG. 18.

tance from the fire plate. The regulation in practice was not as good as one might expect the device. The vaporization by approach of the oil to the hot parts suggested the next step which is so obvious that it seems as if it should have been tried first. This was to simply feed the oil and air through

the same pipe to a pile of rock where the explosive fire is maintained, with the expectation that the hot pipe will do the vaporizing. The oil is fed through cock A, Fig. 16, and the air through B, both reach the fire through the same pipe C, and burn explosively in the mass of rock. This was eminently satisfactory, and showed an action which was very fine, if unexpected.

When the feed is slow the pipe C becomes hot and then does undoubtedly act as a vaporizer, but when the feeds are increased the fire is forced away from the nozzle, as in the case of gases, and the pipe C remains almost cold, no matter how hot the fire in the rocks, but the perfection of the action is maintained and it is found that not the pipe, C, but the hot rocks themselves act as the vaporizer. The air and oil impinge together on the hot mass, spreading out in constant velocity surfaces; the combustion takes place on that surface where the velocity is equal to the rate of propagation and in the passage the oil automatically vaporizes by contact with the same rocks which make the explosive fire possible, and all this happens without diffusion with the products of previous combustion. Thus the function of the rocks becomes complicated; first, starting with gas the explosive fire is made possible by their presence, and the result is the heating of the entire mass from top to bottom, the mass thus heated is a perfect vaporizer for the oil, which, fed with its air makes an explosive mixture and maintains the temperature of the rocks, the whole interrelated series of actions and reactions producing what I have named the "explosive oil fire."

Were the proportions not explosive the interior of the mass would chill and the vaporization would stop. It is a very strik-

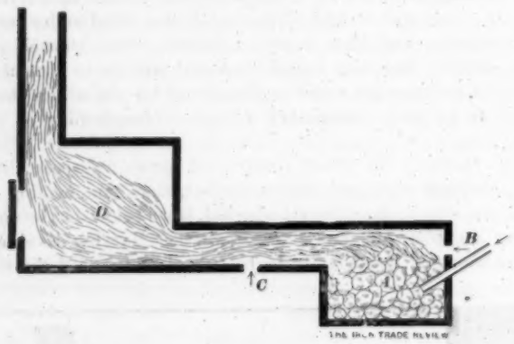


FIG. 19.

ing experiment to withdraw the nozzle from the intensely glowing mass of rock, of a properly working fire, and note the oil drip, drop by drop, giving off each time a dull red flash and a cloud of smoke, while the whole rock mass cools down; a re-insertion of the nozzle causes at once a resumption of the intense rapid high temperature combustion. And, secondly, by a simple change of proportion observe an instant cessation of the action, producing first smoke and then total extinction. This method of burning the oil is perfectly adapted to the purpose for which it is designed, *i. e.*, the combustion of any oil in a closed pressure-chamber, as already described, and the action leaves nothing to be desired.

Naturally the next question would be to determine the action with residue oils of pertoleum. It need only be remarked here that with every oil tried the action was the same; and three fires side by side, burning respectively kerosene, cylinder oil, and linseed oil, showed no difference in action. The so-called residue oils leaves no residue this way. The experiment of feeding the several oils successively through the same fire without interruption resulted in no apparent change of action. We can now see how the action of the brick that Kermide placed on his grates improved the action, which would have been still further improved if the spray had been prevented from diffusing with products before reaching the brick. Moreover, by this simple change the spraying process would be rendered unnecessary. Also in the case of the saturated mat referred to in the earlier part of the paper, it will now be readily seen how the feeding of both oil and air through the same opening, instead of as designed, would have completely changed the action.

Originaly firebrick fragments were used, but the fire was intensely hot, and fused such fragments together, even fluxing them and causing a flow. Later other rocks were tried, and magnesite was found not to fuse; dolomite, also infusible, crumbles slightly. It was noted in the experiments on gas that considerable gas might be added to a mixture in excess of that required for chemical proportions without injuring the explosive properties of the resulting mixture, which fact was of value in producing surface flames above the explosive fires; of course, there will be a point where the explosive property will be lost and extinction ensue.

When an excess of oil was tried the explosive fire between the rock fragments, which act as the automatic-non-diffusing vaporizer, was maintained by the lower and explosive part of the fire, while the excess of oil passed on to be burned above. It was found possible to vary the oil 100 percent without stopping the explosive action below, the effect being merely a variation in the length of the surface flame. This variation at will in the character of the surface flame is of no importance in the problem which was originally set, *i. e.*, the production of a fire for an internal combustion engine working by the increase of volume at constant pressure. It is, however, of the utmost importance in metallurgical and steam-boiler furnaces, and a few experiments other than those originally set were made on these applications.

Fig. 17 shows a series of burners which were used experimentally with success on both open and closed fires, showing the great simplicity that here meets with success. The one at the lower left-hand corner, shows an air chamber of 2-inch pipe through which the oil pipe is led, the air and oil passing downward at an incline of about 30 degrees to the rock bed. Proportions of mixture are maintained by external valves; the outlets may in this type be easily duplicated. The one passing the stool shows a down bending quarter pipe fed with air and oil, and provided with a starting gas cock. About one square foot of rock several inches thick can be kept in a glow with this.

To show that the theory of the formation of combustion surfaces holds with this oil fire as with the gas, a pile of broken brick was arranged to run about fifteen minutes, covered with clay; the result is shown on the top of the chair, a round cavity was fused out and a center lump left, showing what would be expected with this down bending nozzle from the theory, viz., an annular form of combustion surface. The plate on the floor at the right is tapped to receive from below the nozzle lying on the top containing a center vertical oil feed surrounded by the air feed. This does not work well on a flat plate as some oil collects in a circle on the plate, where it meets little air, and is moreover chilled by the plate, a conical brick bottom works better.

Two 6-inch nipples arranged for closed fire-pots are shown, the lower one provided with oil, air, and gas inlets delivering to a pipe which merely enters the wall of the fire chamber. This works very well; after heating by a properly proportioned mixture, the whole becomes dazzlingly hot, and a blue to orange surface flame several feet high can be obtained without disturbing the action of the lower fire. While the whole firepot is white hot and would melt in time, the horizontal feed pipe is always cool enough to be borne by the hand. The very high temperatures that can be produced may be easily estimated when it is stated that this burner can consume a gallon of crude petroleum in about ten minutes and in so doing uses no excess of air.

The upper nipple shown is connected for use with gas, and is provided with a 1-inch clay lining. It is fed from below with a mixture of air and gas from the motor-driven 6-inch positive blower. This was used for melting crucibles of tin, aluminum, lead, copper, etc., in the calibration of a Le Chatelier pyrometer for some experimental determinations of the passage of heat through metal from a hot gas to a cold. In the center of the shelf is shown a 2½-inch cross bottom fed by air and gas direct from the mains and used for heating soldering irons. Kerosene has also been used in this apparatus for the same purpose.

As Applied to a Steam Boiler.

The first application of this method of combustion to a steam boiler is illustrated in Fig. 18. The oil tank in the rear has a delivery pipe starting at the bottom of the tank, and air from

the main is piped to the oil surface and to the burner through the hose; a slight throttling at the the boiler will put enough pressure in the oil to lift it to the burner, where it passes the valve seen in the right front. A half-inch pipe leads to the center of the firebox and then turns down by an elbow; the grate is covered with clay and the firepot filled with broken rock. A gas connection is shown for initial heating and a steam pipe passes from the dome vertically downward in front. It was for observing the action of steam in the fire that this particular apparatus was set up. It was hoped that by the decomposition of the steam in the fire the excessively high temperatures would be avoided and the use of special rock of high fusing point rendered unnecessary. If the fire be started and brought to a steady glow and stem be then admitted, there will at once appear an almost invisible surface flame showing the action desired, a decomposition of steam in the hottest parts and a recombination, more or less complete, beyond at the surface. The steam is thus a sort of heat distributor, and in this way it was found feasible to use common fire-brick; an occasional sticking together is easily broken up at the end of a run by a bar, and everything made as good as new.

It ws also thought worth while to try what could be done in producing reverberatory action, similar to that of coal fires. To this end, this apparatus, Fig. 19, was made of brick and clay. With a 5-inch fire at A, and an air inlet at B and C, a good hot-colorless flame 2 feet long could be produced, heating the chamber D to an even glow with an atmosphere reducing or oxygenizing as desired. It should be noted that all of the explosive burners described will work under any air pressure whatever, a variation merely altering the distance of the combustion surface from the outlet but for burning a given amount of oil a larger air pipe must be used with low pressure air feeds than with high.

In conclusion, it may be said of the method resulting from this experimental research that it seems to be in every way satisfactory for the purpose for which it was derived, and may be of use in other applications. It has no small openings for oil, no possibility of carbonizing; will burn any oil with air at any pressure, provided only that enough air be supplied, and is subject to an almost unlimited variation of form; it will deliver gases at a constant and maximum temperature, which may be lowered to anything desired by air dilution; is capable of burning more oil in less volume than any of the other forms tried, and this with the least possible amount of air. It must be stated as a drawback that without the use of steam it calls for the use of selected rock to prevent fusion.

At the annual meeting of the stockholders of the Youngstown Iron Sheet & Tube Co., held at Youngstown, O., last week, directors were elected as follows: Myron C. Wick, Robert Bentley, C. D. Hine, H. M. Garlick, William Wilkoff, James A. Campbell, H. H. Stambaugh, George L. Fordyce, Harry Dalton, J. L. Severance and James Parmelee. It was decided not to elect a successor to Col. George D. Wick who resigned the presidency some time ago, and an executive board was chosen as follows: Robert Bentley, H. H. Stambaugh, James A. Campbell, Richard Garlick and George E. Day. Officers were elected as follows: James A. Campbell, general manager and vice president; W. H. Foster, secretary, and Richard Garlick, treasurer. George E. Day is the new sales agent of the company.

The statement reproduced in these columns last week from the report of Axel Sahlin, of the British Iron Trade Association's American Commission, was in error in regard to the ore handling outfit at the Lackawanna Steel Co.'s West Seneca plant near Buffalo. There will be five Hulett automatic unloaders and three Brown bridge tramways.

It is probable that the new plant of the Henry Vogt Machine Co., Louisville, Ky., will be placed in operation about September 15. Nearly all the buildings are under roof at the present time and the machinery is being rapidly installed. The new plant will be devoted exclusively to the manufacture of boilers and ice making machinery.

Operations were commenced at the new plant of the Youngstown Steel Casting Co., Youngstown, O., last week.

A SPEED REGULATING DEVICE.

A new device along the line on which many inventors are just now approaching the Patent Office—another attempt to solve the problem of greater convenience in speed variation of machinery—is illustrated in the accompanying engravings. The views given in Figs 1 and 2 illustrate a speed regulator invented by Henry P. White, of Kalamazoo, Mich. Fig. 1 is an end elevation and Fig. 2 is a side view, the former having the tight and loose pulleys removed. The inventor has set out with the intention to provide a speed regulator of the cone pulley type which may be applied in combination with any desired source of power, and a design in which the different portions of the contact surface of the belt travels at the same relative speed upon the surface of each cone. The method of moving the belt to secure the various speeds are arranged so that the hands of the operator do not come in contact with the belt.

The main frame is indicated by A, and B is the driven cone mounted upon a shaft which carries the tight and loose pulleys, through which power may be applied to the machine. A corresponding cone C is mounted upon a shaft located at right angles to the one on which the cone B is fastened, the pulley C' being the medium by which power may be delivered from the machine. A track E is fastened to the main frame, or is a part of A, having a sliding frame D with a shaft I and idlers H. G is a screw and hand wheel by means of which the sliding frame may be moved along the track E. A scale can be stamped or graduated in any convenient way upon a portion of

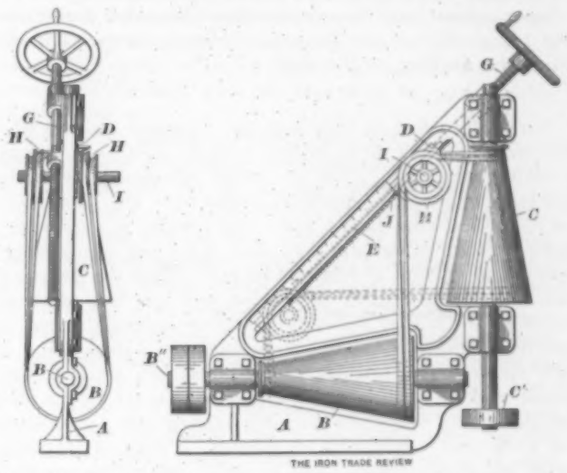


Fig. 1.—End Elevation. Fig. 2.—Side Elevation.

SPEED REGULATING DEVICE.

the main frame and with the aid of a pointer attached to the sliding frame the operator is in a position to know at what speed the driven machine may be running.

The dotted lines show the position of the belts when the sliding frame is moved to the opposite end of the track and the relative places at which the belts are applied will also indicate the proportionate speeds of the cones. On reference to Fig. 2 it will be observed that the same ends of the connecting belts always engage like structural portions of the cones B and C, thus avoiding the necessity of a compensating constant slip at the contact surface of the belts; that is to say, the edge of the belt toward the large end of the cone C is toward the large end of the cone B.

After Aug. 1 the Automobile & Cycle Parts Co., with plants in Cleveland, South Chicago and other points, will transact business under the name of the Federal Mfg. Co. This change of title will not in any manner affect the management of the company or the business of its factories. The products of the company are so diverse that a comprehensive name has become a necessity.

After a strike of five days of 500 employes of the American Steel Casting Co. at Alliance, O., the men have returned to work with a small advance in wages. They were also given a nine hour day.

SUGGESTED AT THE SHOP.

BY F. O. REMAN.

Most men are soon satisfied with any one thing and they hunt for another source of interest and pleasure. But it is a mighty poor rule that does not have an exception and such is the case with the taste of a mechanic for machinery. Whether it is the hope that there may be something that he can improve to his own profit and incidentally to that of the world at large, or whether it be purely the instinct of the man who is playing a game with the mechanical forces and finds in their study and application, a never ending source of recreation, it is not for me to say. There is no doubt, however, that the machinist thoroughly interested in his work finds a solace that is lasting. The joy of doing good work is the natural outcome of the labor of the alert mechanic. Not the only reward, of course, but the pleasure of doing a satisfactory job at the trade, doing it with ease and confidence, is not to be measured in money alone. It does not look that way to everyone and I find any number of people who think that the man following the trade is a mere machine. And by machine, mark you, they mean a non-thinking collection of levers and gearing for the production of some part or another in the industrial structure. A machine smeared with grimy oil that cakes around the shafts and framing in unsightly patches, the point scratched and stained, the rattle of ill fitting gears and the creak of scraping slides, is not a pleasant prospect, I'll admit. When such a machine is treated to a frequent dose of monkey wrench repair it is even less a satisfactory subject. These machines have done good service within their limitations but I don't think it just the proper thing to compare a workman with anything of the sort.

* * * * * *

Personally I find no fault with the talk about the men who are mere machines. Mere machines are in their insistent way teaching something. They are doing missionary service in the cause of good shop conditions, better tools, etc. A machine to do its best must have a good, firm foundation, solid structure, rounded corners and keen edges, quick and steady movements and no stint of lubricant or care. Even the automatic machine does not fulfill its mission with any lack of these. With all the talk of philanthropy, that occasionally comes to the front when shop conditions are improved, I think that it is due rather to the teaching of machines than anything else. Good working conditions and contented men are closely akin to the highly developed machines turning out a maximum of work with a minimum of friction. Plenty of lubricant, stout and neatly joined belting, plenty of light, tough and keen tools, readily suggest the library, reading and lunch room, vacations and the like.

* * * * * *

My acquaintance with machinery and machine makers naturally leads to inventors and their work. Take the editorial in *The Iron Trade Review* on "The Untaken Fields of Invention," for example. There is really no lack of the inventions suggested. The difficulty being in getting the thing on the market. I remember at least a dozen years ago meeting an inventor who had devised a neat means of supporting a telephone receiver. An arm having a swiveling holder for the receiver was hanged to the wall beside the instrument. A light spring held the arm back against the wall and when the user of the device swung the arm outward, the spring had just enough pressure to hold the receiver in place at the ear. When the conversation ended and the operator walked away from the telephone, the arm swung back to its place against the wall and out in the bell circuit automatically. It was a neat and simple scheme but not any neater or simpler thing than has often been put out to take the place of the lead pencil.

* * * * * *

I guess the lead pencil stands as one of the most conspicuous examples of the survival of the unfittest that is extant. Nothing more useful or more of a humbug. We all use it and only tolerate it because of the ease with which its impressions are destroyed. Ink must be called in to make the sketch a permanent record. A penciled letter or postcard would be within a measurable range of an insult. The uncertainty of the point, its liability to break at a critical moment, the strength of the protecting sheath of wood, the nuisance of sharpening the aggravating combination, are patent to all, but————————.

* * * * * *

Metal tubes and paper shells have been arranged to protect the lead. The metal tubes with all sorts of neat contrivances for retaining and propelling the lead into place as the point wore away. The paper shells made with layers spirally wound so that an easily removed strip would bare another section of lead. But none of these approach the popularity of the plain, ordinary, everyday lead pencil. It is the chosen tool of the designer, the old standby of the tool maker, from engineer in chief to shipping clerk, it marks every step of the way from preliminary sketch to the machine crated on the cars. Even as I write a third more or less of these users of the pencil are industriously paring it to better working conditions.

* * * * * *

I would not say that this is a sheer waste of time. The paring of a pencil may be equivalent to the smoking of a cigar; it may be the needful aid to the ripening of an idea. I don't want to bear down on the lead pencil too hard. It is superior to a fountain pen anyway and everywhere, and if it does not do all that it should that is simply and solely because the designers of machinery have not got round to its improvement. Its limitations are dear to them and they may not want to have it otherwise. So far as that goes the entire draftsman's kit of tools is in the same condition. There is the one place in the shop equipment where improvement is not the order of the day. Perhaps if the other conveniences mentioned in the editorial, the slide rule and the rest, were not so generally thought of as the equipment of the drafting room they would be more commonly found in use.

Distribution of New Blast Furnaces.

The *Bulletin* of the American Iron and Steel Association says that on June 30 there were 28 blast furnaces in course of erection in the United States, of which 24 will use coke for fuel when completed, 2 will use anthracite coal and coke mixed, and 2 will use charcoal. These furnaces are located in the following States: New York, 4 coke; New Jersey, 1 anthracite and coke; Pennsylvania 11, of which 1 in the Lehigh Valley will use anthracite and coke, and 6 in Allegheny county, 1 in the Shennago Valley, and 3 in other counties in Western Pennsylvania will use coke exclusively; Virginia, 1 coke; West Virginia, 1 coke; Tennessee, 1 charcoal; Alabama, 2 coke; Ohio, 2 coke, 1 at Cleveland and 1 at Toledo; Illinois, 1 coke; Michigan, 1 coke and 1 charcoal; and Colorado, 2 coke. A few of these furnaces will be completed and blown in before the close of 1902, but the majority will not be ready for blast until 1903. In addition to the new furnaces enumerated above several coke furnaces are projected and a number of old furnaces are to be rebuilt during 1902 and 1903.

Obituary.

William H. Orcutt, one of the directors of the American Foundry Co., died Saturday, July 19, at his home in Indianapolis, Ind., aged 44 years. For several years he was superintendent of the McElwaine-Richards Co., of Noblesville, Ind.

Patrick Breody, the first superintendent of the blast furnaces of the Bethlehem Steel Co., died at his home South Bethlehem, Pa., on Friday, July 25, at the age of 66.

George Hayden, general attorney for the Cleveland-Cliffs Iron Co. at Ishpeming, Mich., died at the Presbyterian hospital in Chicago, Wednesday, July 23.

The *World's Work* is the magazine of the man of affairs. The August number has a particularly interesting article on "The Twenty-Hour Special—From New York to Chicago," plentifully illustrated. Ray Stannard Baker explains "How Labor Is Organized," and O. P. Austin, the talented chief of the Treasury Department Bureau of Statistics, answers the question "Will Our Commercial Expansion Continue?" The number has some noteworthy articles comprising a midsummer vacation series, with which there are 100 illustrations.

MODERN ROOFING TIN.

A correspondent "W," in a recent issue of the *Railway Review* discusses the durability of terne plates for roofing purposes, and the methods adopted in their manufacture calculated to increase their wearing quality. We quote from the article as follows:

For some time past there has been frequent controversies in trade circles about the quality of terne plates (roofing tin). It is universally conceded that, all things considered, the thin sheets of iron and steel when well covered with the non-corrosive alloy of tin and lead are the most convenient and most serviceable form of roofing material. Terne plates are pliable and can be worked around sharp corners as well as on rounded or flat surfaces. The nature of the coating is such that the several plates can be seamed and soldered together into one large sheet of unbroken surface, which by means of the several seams is sufficiently flexible to allow for contraction in cold and expansion in hot weather. The rigidity and toughness of the steel, which forms the base of terne plates, makes the latter unbreakable and yet their weight is less; and being non-combustible affords better protection against fire than any other roofing material. These, and many other merits possessed by roofing tin are conceded by everybody, but the contention is that terne plates made in recent years do not possess the same lasting qualities which in former years made this class of roofing stand without a peer in the roofing business. The blame for the alleged deterioration is generally but erroneously placed on the fact that soft steel has been substituted for wrought iron.

Before the Bessemer and open-hearth or Siemens-Martin steel processes were invented the iron base of the coated sheets (commonly called "black plates") was, like all other forms or shapes of wrought or forged iron, rolled from blooms, produced in the knobbling fire or puddling furnace, but now Bessemer and open-hearth soft steel are being used almost exclusively.

It seems reasonable that our steel makers did not and could not know at once for a certainty what ingredients and qualities of raw materials were required for roofing-tin purposes, and they may have occasionally made a miss of it; but everybody who became acquainted with the new steel process saw at once that the latter afforded far better facilities for homogeneousness and uniformity of product than the old methods. As is nearly always the case, so it is here, when people receive an inferior quality of the new product they will make comparison with the best class of material that had been made in the old way, forgetting entirely how often they had to hear complaints of various defects; such as that sheets were blistered or so brittle that they could not stand plain seaming, etc., defects which have been almost entirely eliminated by the steel process.

The nature of soft steel is, of course, different from that of wrought iron and it must be admitted that while the advantages possessed by the substitute outnumber by far the disadvantages, some of the latter were encountered at first and it took time and study to overcome them, but that has now been successfully and completely accomplished.

At the present time a number of the great steel works, having recognized the importance of the tin-roofing trade, make soft steel bars for high grade roofing tin purposes a specialty. We find that the raw iron for these bars is carefully selected, analyzed and inspected. The melting and casting of the ingots are done in a manner which eliminates or rather brings to the surface of the molten metal all the impurities that may have been contained in the raw material, and these are removed before the metal sets. As a further safeguard the top of the ingot is cropped before it is rolled into the "tin bars," and thus there are absolutely no impurities left in the metal that could cause disintegration from inside to out. The iron in the steel tin bar and consequently in the black plates, is purer than it could ever be in wrought iron.

Some people have argued that the purity of the steel is the very cause of its quicker oxidation, but, however, that may be as regards uncoated steel goods, pure iron will not rust if it is removed absolutely from contact with the atmosphere by a covering of such non-corrosive metals as tin and lead.

It would be a strange fact indeed if in spite of all the progress that has been achieved and in spite of all the scientific researches we would have to go back to old and obsolete methods in order to produce good roofing tin. We now have the evidence that the once existing difficulties have been overcome, and that good roofing can be obtained by those who will go to the trouble and look for it.

A coating process which will assure a thorough amalgamation of the coating mixture with the body of the plates is most essential in the production of reliable roofing tin. A careful study has revealed the fact that inferior coating methods are to blame for the production of inferior roofing tin rather than the substitution of soft steel for wrought iron.

It was unfortunate that almost simultaneously with the introduction of Bessemer and open-hearth steel a number of new coating processes were tried, and introduced with the view of reducing the cost of production, but the reduction if effected was in most cases at the sacrifice of quality.

At present there are yet a number of coating processes in vogue, and users of roofing tin will do well if they post themselves on the merits of the same. The U. S. Navy Department, which is known to be most careful in its investigations and strict in its requirements, has adopted the following in its standing specifications for roofing tin:

"All roofing tin to be made of best quality soft steel as a basis.

"Coating to be thoroughly amalgamated with the black plate by the palm oil process. This coating must be applied so that the sheets be evenly and equally coated on both sides and the coating equally over each sheet. After the plate has been cleansed in a weak acid solution it is to be thoroughly washed with water, after which nothing is to be brought in contact with the black plate but pure palm oil, pure new tin, and pure new lead."

Many of the leading architects are adopting the same, or nearly the same specification. The amalgamation of the coating metal with the body of the black plate by means of the palm oil process (often called the "MF" method) has stood the test of time and has been found to be the most reliable.

Among the new inventions which have been made in coating methods is one which possesses real and high merit. This new method is a finishing process through which the plates pass after they come in a hot state out of the tinning pots. The treatment which the plates receive effects an instantaneous setting of the hot fluid coating while they are lying in a horizontal position in a bath of oily substance, the temperature of which is below the fusion point of the coating alloy. In this position the coating metal cannot run and must set at once uniformly all over the sheet and the coating will be evenly thick from end to end and from side to side. The plates receive a smooth mottled surface free from dirty grease, clean to handle and when finished have in addition to the metal coating a cover of transparent paint that does not interfere with the soldering qualities of the plates, but acts as additional protection against atmospheric influences. This method, when applied to plates that have been coated by the "MF" process, is an absolute insurance against corrosion.

The advocates of the restoration of the old iron base roofing tin frequently fortify their arguments by pointing out roofs which, though covered with roofing tin twenty-five, thirty, or forty years ago, are still intact. While such is a good argument in favor of tin roofing generally, it does not furnish a comparison between the lasting qualities of iron base and steel base tin roofing, for the tin roofs which wore out during the same period are not here any more, and as no record has been kept of them, no one can know the proportion between long lived and short lived iron base tin roofs, and therefore these arguments are somewhat in line "with the pies that mother used to bake." On the other hand "MF" roofing tin has been made with soft steel as a basis since 1878 and there are many roofs covered early in the eighties that still exist in good condition.

If the users of roofing tin will go to the trouble of paying close attention to the material which is put on their houses and will specify brands that bear the stamps of and are guaranteed by the manufacturers, they will find that roofing tin can be obtained which is better and will last longer than any that was made in olden times, and they will also find that tin roofs are still the best house covering and being the best will be the cheapest in the long run.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of Their Wants:—

The Cambridge Rolling Mill Co., Cambridge, O., is in the market for a saw suitable for cutting 12, 16 and 20-pound rails and also for a two-spindle rail drilling machine.

The Clauss Shear Co., Fremont, O., is in the market for a second-hand engine lathe of 30-inch swing.

The Enamel Steel Tile Co., Bellaire O., which was recently incorporated, has purchased a three-story brick building on the river front, size 110x110 feet. Equipment, modern in every particular, has been ordered. The company will manufacture enamel steel tile for wainscoating, hearths, mantels, ceilings, etc. This tiling will be made in all sizes, designs and colors.

The Gleason, Bailey & Sciple Mfg. Co., Seneca Falls, N. Y., has been incorporated with a capital of $200,000 to manufacture pumps and hydraulic appliances.

The Lovewell-Henrici Co., with principal office at 1 Montgomery St., Jersey City, N. J., has been incorporated with a capital of $75,000 to manufacture machinery.

The Vail Gasoline Machine Co., of Marshall, Ia., has been incorporated with $25,000 capital for the purpose of engaging in the manufacture of gasoline engines. Merritt Green has been elected president; C. C. St. Clair, vice president; John D. Vail, secretary and treasurer.

The Guilderland Foundry Co., of Guilderland, N. Y., has increased its capitalization from $3,500 to $25,000. William S. Andrews, Robert Magill, Charles G. Zeilman and J. E. Carpenter are the directors.

The Central Malleable Iron Co., Decatur, Ill., has been incorporated with $60,000 capital for the purpose of engaging in the manufacture of malleable castings. G. A. Hackett, J. P. Utt and T. J. Arnett are the incorporators.

The Lagonda Mfg. Co., of Springfield, O., has been incorporated with $10,000 capital for the purpose of engaging in the manufacture and sale of boiler tube cleaners. H. S. Bradley, H. F. Weinland, J. W. Gunn, C. D. Pence and Baldwin McGrew are the incorporators.

The United Steel Co., of Canton, O., has been incorporated under the laws of the State of Delaware with $500,000 capital. The company will erect an open-hearth plant and finishing mills at Canton, O.

The Bon Air Coal & Iron Co., of Chattanooga, Tenn., has been incorporated in Maine with $5,000,000 capital. The new company will engage in the mining of iron ore and coal and will also erect coke ovens for the coking of coal for blast furnace purposes. The directors are as follows: John P. Williams, W. C. Dibrell, S. J. Keith, T. M. Steger, Edgar Jones, M. M. Gardner, J. M. Overton, A. H. Robinson, S. Murray, M. J. Berry, and E. F. Whittum. John P. Williams has been elected president and W. C. Dibrell, treasurer.

The Pequannock Foundry Co., of Bridgeport, Conn., has been incorporated with $10,000 capital for the purpose of operating a gray iron foundry. Tracy B. Warren has been elected president; P. P. Anderson, secretary, and A. R. Heuttig, secretary.

The Gerling Mfg. Co., of Edwardsville, Ill., has been incorporated with $50,000 capital to manufacture farm implements. C. H. Gerling, W. S. N. Wander and J. W. Garnett are the incorporators.

Nortonville Coal Co., Nortonville, Ky., will buy a hoisting engine, boilers, self-dumping cages, mine cars, screens, electric plant, etc., for 1,000 tons daily capacity.

E. B. Thaw, Coffeyville, Kan., wants estimates on construction of rolling mill to consume 100,000 pounds of scrap iron daily.

S. G. Langford, Silverton, Tex., is in the market for lightweight cog wheels 3 to 18 inches across, also balance wheels, chain wheels and chains.

The New Steel & Iron Co., which was recently incorporated with $100,000 capital, has taken over the Hackettstown Furnace, at Hackettstown, N. J., formerly operated by the Carteret Steel Co. The plant will be operated in connection with the production of steel by a new process invented by Henry A. Jones. John McLaren is president of the new company; I. H. Radford, vice president; John B. Wood, secretary and treasurer, and Charles J. Luther, manager.

John P. Symons, of Muskegon, Mich., has decided to erect a $20,000 foundry at Centralia, Wash. A company is to be organized to push the project. A site has been donated for the plant.

The Wilson Steam Boiler Co., of Omaha, Neb., has been incorporated with $40,000 capital for the purpose of engaging in the manufacture of steam boilers. John Miller Wilson, J. Morris Wilson, and C. A. Johnson are the incorporators.

The A. & C. Mfg. Co., 1120 Payne Ave., Cleveland, has been incorporated with a capital of $10,000 by Wm. E. Patterson, S. A. Hill, Cornelius Maloney, J. F. McAnnick, and J. W. Mott. The company will make electrical machinery and small castings of various kinds.

The recently incorporated Union Machine Co., Zanesville, O., has purchased and will take possession of the Blandy machine plant and equip it with the latest machinery.

The Caldwell Car & Mfg. Co., of Caldwell, O., has been incorporated with a capital of $100,000 under the laws of West Virginia by John R. Cavanaugh, J. J. Burke, and W. J. Kirk, of Pittsburg; Chas. S. Bock, of Sharpsburg, and Chas. B. Truks, of Allegheny, Pa.

The Indiana Rolling Mill Co., New Castle, Ind., has been incorporated with a capital of $300,000 and will build a rolling mill employing about 600 men.

The American Excelsior & Machine Co., of Baltimore, Md., recently incorporated with a capital of $100,000, will build an improved excelsior machine under patents granted James R. Bate. The company will also operate one or more plants manufacturing excelsior for sale. Jules W. Leroux is the president of the company, James R. Bate, the vice president and general manager, and J. Milton Lyell, secretary and treasurer.

The Eureka Foundry Co., of Nashville, Tenn., has been incorporated with a capital of $25,000, by John Stagmier, Leo Strahle, G. B. Fletcher, B. R. Hodge and W. W. Delaney, to manufacture iron and brass products. An old foundry building is being rebuilt and equipped with new machinery for plant.

New Construction:—

The J. A. Fay & Egan Co., of Cincinnati, O., has purchased a tract of 93 acres of land near Cincinnati upon which at an early day the company will erect a new plant for the manufacture of wood working machinery.

The Oswego Tool Co., Oswego, N. Y., has purchased the property adjoining its plant for much needed additions.

The P. M. Sharples' Separator Works, Morristown, Pa., will erect an addition to its foundry, 40x100 feet.

The boiler works Reeves Bros., of Alliance, O., are erecting to take the place of their plant destroyed by fire will be extensive and well equipped. The machine shop department will occupy a building 100x250 feet. The erecting department is 120x375 feet and the smithing department and engine room are in a building 120x96 feet. It is expected the plant will be completed in 60 days.

The plans for the new plant of the Cleveland Pneumatic Tool Co. are just about completed, and contracts will be let at an early day for the construction of the buildings. The company has just opened up an office at 411 Park Building, Pittsburg, in charge of Chas. L. Nelson, and at 34 Lemoine St., Montreal, Can., where it is represented by N. J. Holden & Co.

The recent increase of the capital stock of the Aurora Foundry Co., Aurora, Ill., from $25,000 to $40,000 was for an addition, which is now being built. It will be 91x70 feet and will give a capacity of 20 tons per day, an increase of 8 tons.

The Basset-Presley Co., Cleveland, has closed the deal for the purchase of a site for its new warehouse, heretofore mentioned in these columns. The building will be located on Clifton St. between St. Clair and Superior Sts., and will be 360x160 feet, two stories.

The buildings for the McKeesport Mfg. Co.'s new tin plate plant at McKeesport, Pa., consist of a hot mill building 75x350 feet, cold mill building 75x350 feet, and a tin house and storeroom building 50x600 feet. The most modern machinery will be installed. Ten hot mills and 10 cold mills are

under way, with a capacity of 40,000 boxes of tin plates a month.

The National Rolled Steel Car Co., which was to have located at Moravia, south of New Castle, Pa., will instead erect its plant at Mercer, Pa., where 270 acres have been purchased.

The Lake Erie Iron Co., Cleveland, will erect an addition to its bolt and nut plant at a cost of $12,000. It will be two stories and 60x180 feet.

The Alamo Mfg. Co., of Hillsdale, Mich., has increased its capital from $25,000 to $75,000, has purchased six acres of land, and is building a foundry and machine shop.

The Rockdale, Ill., plant of the American Steel & Wire Co., is being improved by the erection of a power house and pumping station. Electricity is being substituted for steam.

Letson & Burpee, Seattle, Wash., have purchased a site 90x300 feet and will build a large foundry.

The Chesapeake & Ohio R. R. has begun preparations for rebuilding its machine shops at Lexington, Ky.

John P. Symons, of Muskegon, Mich., has made a contract with the Commercial club, of Centralia, Wash., to establish a $20,000 foundry and repair shop in the latter city. The people of Centralia have subscribed the amount necessary to purchase a site for the plant.

The Farmers' Mfg. Co., of Sebring, O., has completed an addition to its foundry. The company has been very successful since moving from Massillon, O., a year ago.

The Hutchinson Foundry & Machine Co., Hutchinson, Minn., is now using its new warehouse, 40x88 feet, the erection of which was made necessary by the increasing business of the company.

The North & Judd Mfg. Co., New Britain, Ct., has let the contract for a factory building to be used as a tinning room. It will be brick, five stories, 50x140 feet.

Hartford Machine Screw Co. is to build a factory building, 98x21 feet, at Hartford, Ct.

A new plant will be erected by the Sterling Wrench & Tool Co., Dixon, Ill.

The Bettendorf Axle Co., Davenport, Iowa, has plans perfected for a new plant of four buildings, each 700x240. A foundry will also be erected.

The Anderson Electric Co., St. Louis, has plans for a six story factory, 108x50. Cost, $125,000.

The Johnson Electrical Construction Co., Milwaukee, will erect a seven story brick store and factory building at a cost of $100,000.

The Jessop Steel Co., the Pennsylvania corporation which is erecting a plant at Washington, Pa., for the manufacture of high grade crucible sheet steel, expects to begin the manufacture of steel within the next 60 days. The site at Washington contains 40 acres. Natural gas, of which there is an abundant supply, will be used as fuel. The equipment is modern throughout. The annual capacity at the outset will be about 10,000 gross tons. No bars will be rolled, and the Jessop bar steel will continue to be imported. Wm. Jessop is president of the company, Sydney J. Robinson, vice president, and James Jessop secretary and treasurer.

Simpson Bros., of Portsmouth, O., manufacturers of fire brick molds, presses, dies, wheelbarrows, and iron and brass castings, are now preparing to manufacture wet or dry clay pans for fire brick works. They are building a new foundry 50x58 feet and expect to have it finished in August. The firm makes new or relines about 300 of C. E. Simpson's patent brick dies in a year.

Fires and Accidents:—

The iron works of the Winslow Bros. Company, Chicago, were badly damaged by fire July 25. The loss, $25,000, is covered by insurance.

The Pittsburg District:—

The Dewey Iron & Steel Co., of Pittsburg, has been incorporated with a nominal capitalization of $1,000 under the laws of the State of Pennsylvania. The incorporators have options on a large amount of coal land at Brady's Bend, Pa., and it is their intention to erect a blast furnace. Efforts are now being made to sell the stock in the company to provide funds for the erection of the new plant.

At the annual meeting of the Eclipse Mfg. Co., of Pittsburg, held last week it was decided to increase the capital stock from $50,000 to $100,000 for the purpose of taking up the manufacture of railroad, mining, and bricklaying tools. No change was made among the officers.

The Scaife Foundry & Machine Co. will erect a new foundry at a cost of $16,000 to replace the plant recently destroyed by fire. The foundry will be modern throughout and the building will be built of steel.

It is reported that the Vulcan Crucible Co., of Pittsburg, whose plant is located at Monaca, Pa., will shortly increase its capitalization from $600,000 to $1,000,000. The plant is being greatly enlarged at the present time by the installation of a rolling mill and open-hearth furnace together with eight puddling furnaces.

General Industrial Notes:—

The Laughlin Nail Co., of Wheeling, W. Va., recently increased its sheet mill from a four-mill to a six-mill plant and its galvanizing works from one to three pots.

On the completion of its galvanizing and roofing plant early in October the Tuscora Steel Co., of Newcomerstown, O., will be able to furnish black and galvanized sheets, corrugated roofing and siding, and eave trough and conductor pipe.

The machinery formerly used in the tube factory of the Shelby Tube Co., at Toledo, O., is being shipped to the Shelby, O., factory, whose output will be largely increased. About 100 more men have recently been employed at the Shelby plant.

The Burt Mfg. Co., Akron, O., has just received a contract for 25 Cross filtering equipments and 111 exhaust heads for shipment to London.

The Falcon works of the American Tin Plate Co., at Niles, O., will be reopened and it is understood that extensive improvements will be made.

The affairs of the Hudson Iron Co., of Hudson, N. Y., in the hands of a receiver since 1897, have been closed by order of court.

Peter Schneider, formerly of the Schneider-Kohn Machinery Co., Cleveland, has organized the Peter Schneider Co. and will carry on business in machinery and tools at 126-130 Champlain St.

The United Shoe Machinery Co., of Boston, has purchased the T. A. Norris Co., of Brockton, Mass., a company engaged in the manufacture of shoe machinery and findings.

The plant and ground of the Standard Boiler Mfg. Co., Chicago, has been sold to the Great Northern Construction Co., for $25,000.

The George A. Fuller Construction Co., of New York city, has purchased the Passaic rolling mill and bridge works, Paterson, N. J. The annual capacity of the steel plant is 15,000 gross tons of acid and 25,000 tons of basic ingots. About 100,000 gross tons of rolled products are turned out annually. Annual capacity of bridge works, 12,000 gross tons. The company employs about 3,000 men. The price paid by the Fuller company is said to be $1,500,000.

The Northern Engineering Works, Detroit, Mich., report among other sales and installations of their three motor electric traveling cranes, in the Cleveland district, through Chas. E. Stamp & Co., sales agents, New England Bldg., Cleveland, the following: American Steel & Wire Co., one 25-ton 40-foot, one 50-ton and one 15 ton, 5 motor; Theodore Kundtz, one 10-ton and one 5-ton; Shelby Tube Co., two 3-ton; Republic Iron & Steel Co., one 15-ton ingot crane and one 3-ton; Novelty Iron Works, Canton, one 10-ton; Aultman & Co., Canton, one 10-ton; Youngstown Steel Casting Co., one 20-ton and two 5-ton. In addition a large number of smaller electric and hand power cranes were placed in the same district.

The William Tod Co. has awarded the following contracts for its buildings to be erected on the site vacated by the W. B. Pollock Co., at Youngstown, O.: Erecting shop, 70-foot span, 70 feet high and 200 feet long; machine shop, 50-foot span, 50 feet high and 200 feet long. The structural fitting will be done at the Youngstown plant of the American Bridge Co. A large amount of machinery is also being installed

and among the large tools recently purchased are the following: 14-foot planer, Pond Machine Tool Co., Plainfield, N. J.; 24-foot boring mill, Niles Machine Tool Co., Hamilton, O.; 10-inch floor boring and milling machine, William Sellers & Co., Philadelphia, Pa.

Officials of the Wilmington Malleable Iron Co., Wilmington, Del., have about decided to remove their plant from that place. It is probable that it will be located at Chester, Pa.

Rapid progress is being made on the erection of the plant of the Commonwealth Steel Co., St. Louis, Mo., located at Granite City, Ill. The buildings are to be completed in September and according to present indications they will be completed on time. The erection of the open-hearth furnaces is also progressing rapidly and it is probable that upon the completion of the buildings the furnaces will be ready for their first cast of steel. The plant is located on a tract of 18 acres and the buildings cover about 8 acres. The initial daily capacity of steel castings will be about 150 tons although this will be increased later. The company will make a specialty of railroad work. The foundry will be modern in every particular and molding machines are to be installed for all the duplicate work of which there will be a large amount.

The Goulds Mfg. Co., of Seneca Falls, N. Y., reports a very heavy demand for all of its different styles of pumps. This is especially true of large triplex power pumps for which a special plant was recently erected. The company is so heavily filled with orders that it is in great need of additional molders and additional machinists, and has permanent employment for a number of new men.

The Continental Coal Co., of Glouster, O., has ordered from the Buffalo Forge Co., of Buffalo, three large fans, which have been installed in the Glouster mines for the purpose of ventilating and for exhausting fumes, smoke and all dangerous gases. The fans are 250 inches, housing of the ¾ type and of the special width of 72 inches. The sides are built of extra heavy steel plate and are braced with angle irons to prevent vibration. The blast wheels of these fans are of the usual centrifugal type. The radial blades or vanes with backwardly curved tips are supported by two spiders of wrought iron tees springing from cast iron hubs and are further stiffened by the conical side plates.

The Warwick Furnace & Mfg. Co., Massillon, O., organized this year, is manufacturing a sheet steel furnace so constructed as to give a large radiating surface and produce proper combustion. The steel extends below the ash box and is there riveted and seamed to prevent the escape of gas into the air chamber. These furnaces are made in three styles of three sizes each. The officers of the company are: H. B. Croxton, president; S. T. McMeeken, vice president; D. S. Souers, secretary and manager; W. B. Humberger, treasurer. Offices are at Massillon and works at Warwick, O.

President F. N. Hoffstot, of the Pressed Steel Car Co., Pittsburg, Pa., announced this week that the company has orders on its books for steel cars that will aggregate $30,000,000. As the average price of a car is $1,000 it is estimated that contracts call for about 30,000 cars or one year's output of the Allegheny and McKees Rocks plants. The average daily production of the plants is 110 cars, but this will be increased to 36,000 cars per annum as soon as improvements contemplated are completed. At the Allegheny plant 500 additional horsepower boiler capacity is being installed. At McKees Rocks a 1,000-ton flanging press has been ordered from Philadelphia. The McKees Rocks plant will also get a 120-inch shear and a large amount of additional machinery, the idea being to increase the plant's present output very materially. For the Pennsylvania Railroad the company is turning out 2,500 50-ton hopper cars for the coal trade, to be delivered in November and December. These are being built at Allegheny. The Pennsylvania Railroad also ordered 725 drop-end and drop-side gondolas to replace missing numbers or cars, that have been wrecked.

PHILADELPHIA MARKET.

[Continued from page 23.]

iron, 1.95c to 2c for city or near-by deliveries. Beams, angles, etc., 2.35c to 2.75c for foreign from store or ex-ship; mill shipments, 2.75c to 3c f. o. b. sellers' mills for reasonably prompt delivery.

OLD MATERIAL.—The demand is good in some lines and not so brisk in others. Prices are unchanged and are about as follows: Old steel rails, $21 to $21.50; heavy steel scrap, $21 to $21.50; low phosphorus scrap, $27.50 to $28.25; old steel axles, $27.50 to $28.50; old iron axles, $29 to $30; old iron rails, $25 to $26; old car wheels, $20.50 to $21.50; choice scrap railroad No. 1 wrought, $23 to $24; country scrap, $18.75 to $19.75; machinery cast, $18.50 to $19; No. 2 light scrap, forge, $18 to $19; No. 2 light scrap, ordinary, $15.50 to $16.50; wrought turnings, $16.50 to $18; wrought turnings, choice heavy, $18.50 to $19; cast borings, $10.50 to $11; stove plate, $13.75 to $14.50.

CARTER BALL-BEARING CHAIN.

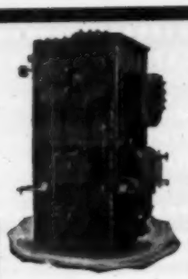
The Monongahela Iron & Steel Co., of Pittsburg, is just placing on the market a line of ball-bearing chains, ranging in sizes from 3-16 to 2½ inches, which are adapted for all purposes to which the present link chains are put. The ball-bearing chain is made with a concave groove on the inner side of the links with a stud placed in the center of each link and is finished between dies, thus giving a uniform length and width to each link and making it solid and rigid throughout. The concave link retains the oil between the links and around the balls, thereby preventing wear and friction. This chain when put together is uniform, with the balls interposed between the ends of the links. On account of the concave groove in the iron the ball-bearing chain will stand from 10 to 15 per cent more weight than the same area of round iron before allowing the link to bend. In addition to this it has a stud in the center of the link as described, which also prevents bending and allows the link to work freely with excessive loads. This stud prevents the links from gripping each other until the breaking strain is reached, allowing the iron to stretch to its full requirement.

The chains are made from the well-known Carter brands of charcoal bar iron, now specified by the United States Government and the manufacturers make among others the following claims: Reduction of friction. More bearing surface on ends of links and less friction. Can be used on smaller drums and will require less power to operate. The links being uniform in size will fit the wildcat or drum perfectly. A ball being interposed between the ends of the links always forces

CARTER BALL-BEARING CHAIN.

the chain to pull in a straight line with equal strain on each side of the link, thereby getting full power of the chain. The chain will not tangle. The stud in the link is retained in place by the concave groove and it practically makes a solid link. The balls being interposed between the ends of the links prevent the links from coming in contact with each other, and overcome irregularity in the scarfing or welding. The chain when coiled around a sheave or drum will not bend the link in any way, as the construction of the link prevents. The concave groove retains the oil around the ball, which overcomes wear and friction. All the chains made are tested on the Tinius Olsen & Co.'s testing machine, which has a capacity of 600,000 pounds.

T. Alexander & Co., of Barcelona, Spain, representing the interests in that country of the Brown Hoisting Machinery Co., of Cleveland, and other American manufacturers of machinery, etc., are reported to be about to open an extensive warehouse for the display of machinery manufactured in the United States.



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Will save you from 5% to 20% of your entire fuel bill—even if you run your engines condensing, or use your exhaust steam for drying or heating systems.

A Cochrane Heater

Will enable you to increase your steaming capacity without increasing your present fuel consumption or the number of your boilers.

A Cochrane Heater

Will prolong the life of your boilers by making provision for taking out of your boiler feed-water the scale-forming impurities that are in suspension or that can be precipitated at the temperature of exhaust steam.

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Is properly and simply designed, and strongly and durably constructed of the best materials that can be used for each particular purpose. If *this* is the kind of a Feed-Water Heater and Purifier you want, you want

A Cochrane Heater.

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Clearfield and 17th St.,

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210 TO 212 DEGREES OF HEAT EASILY ATTAINED FROM EXHAUST STEAM BY THE USE OF STILWELL'S FEED-WATER HEATER,

AND THE WATER DELIVERED TO YOUR BOILERS IS PURE AND FREE FROM SCALE PRODUCING ELEMENTS.

PARTICULARS FREELY FURNISHED.

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Coke Charcoal Roofing

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SHEET METAL STAMPING

DIFFICULT WORK A SPECIALTY

LARGE FACTORY FACILITIES

THE AUTOMOBILE AND CYCLE PARTS CO.

SMITH STAMPINGS FACTORY

MILWAUKEE, WIS.

COLD ROLLED STRIP STEEL

ALL WIDTHS, GAUGES AND TEMPERS

IN COILS OR CUT TO LENGTH

THE AUTOMOBILE AND CYCLE PARTS CO.

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"THE NUT THAT STAYS"

The Elastic Self-Locking Steel Nut

It goes on the bolt with a slight grip that holds it from ever working loose like the ordinary nut, and requires no nut-lock or other fastening to hold it. For use on Cars, Track, Bridges, Machinery, etc., where nuts must stay it is greatly superior to the common iron nut and costs less. Our Elastic Nut Track Bolt makes the best and cheapest rail fastening. Write us for booklet, samples and prices on Sq. and Hex. Nuts, Machine Bolts, Track Bolts, Structural Rivets, etc. Address

NATIONAL ELASTIC NUT CO., Milwaukee, Wis.

PERFORATED PLATE SCREENS
AS REQUIRED FOR
Stone, Ore, Zinc, Lead, and all Railroad and Mining Uses.
SPECIAL SCREENS FOR COAL AND COKE.
HENDRICK MFG. CO.,
Samples and information upon request. Carbondale, Pa.

Allis-Chalmers Co.,
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Perforated Plates

for Incline Shaking and Revolving Screens for Coal Washing and Cleaning, and all other purposes.

Write for Prices.

Do You Seek Trade With the Foundries?

THERE are 5,933 foundries in this country and Canada.

1,055 of these are new concerns which have come into existence during the past two years. More than 600 foundries quit business during the same period.

The chances are that your mail matter does not reach all of the new firms. It is also a safe proposition to gamble that you are sending out letters right along to people who have quit the foundry business.

The way for you to cover the foundry trade completely is to have a copy of

Penton's Foundry List
FOR 1902

in your office. This is the only reliable directory of foundries published. It is now ready for delivery. Only a limited edition will be printed, so you had better order a copy early.

The salesman on the road says that with a copy of this list in his pocket he can get over the ground in half the time and see everybody. Without it he is looking up people who have no foundries and missing others who have. It will be money in your pocket to see that your men have a copy.

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STITCHED COTTON DUCK BELTING,

Especially adapted for Main Drivers, Saw Mills, Cotton Gins, Cotton Presses, and for all places where belts are subjected to moisture or atmospheric changes, the "GANDY" stands paramount.
For further information, prices, etc., write

THE GANDY BELTING CO., Baltimore, Md.

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Perfectly tight under all pressures of steam, oils, or acids. Warranted to give satisfaction under the worst conditions
RECEIVED THE HIGHEST AWARD **GOLD MEDAL** *AT THE PAN-AMERICAN EXPOSITION*
Insist on having the genuine stamped with Trade Mark
JENKINS BROTHERS, *New York, Boston, Philadelphia, Chicago.*

The American Iron and Steel Association has just completed a thorough revision of its well known

Directory.

The work of revision has been complicated by the succession of changes in the iron industry, that have followed so rapidly in the past three years.

The New Directory contains about 50 pages more than its predecessor of 1898, and is a cloth-bound volume of nearly 450 well printed pages.

It gives in the first 150 pages a full list of the **consolidations and reorganizations** that have taken place in the American Iron Trade in the past three years, with a full description of all the properties taken over, with their products, names of previous owners, etc.

Then follow 164 pages giving a complete description of all the iron and steel works not in consolidations. These are arranged by states.

Part 3 gives a classification by states of the iron and steel works of the United States, except blast furnaces, according to their products—Bessemer, Open-Hearth, and Crucible Steel Works, Steel Casting Works, Rail Mills, Structural Mills, Plate, Sheet and Skelp Mills, Tin Plate Works, Cut Nail and Wire Nail Works, Wire Rod Mills.

This Directory will be found invaluable to all concerns having business with iron and steel manufacturers in any line. The price is $10, postpaid.

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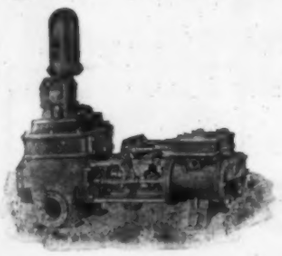
The Blakeslee Jet Pump



is always ready to do your pumping as long as you have steam at your command. It will pump sandy and impure water which other pumps cannot handle. There being no valves on the **Blakeslee Jet Pump,** there is nothing to wear out nor anything to get out of order. Coupled with reliability under all conditions the **Blakeslee** shows exceptional economy.

Ask us to mail you further particulars.

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PROTECT

From Rust, Fire, Sun, Water and Weather by using our products. . .

Pure Red Lead

Kept from settling by our **Double Oxygenized, Pure Linseed Oil.**

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Prescott.

Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.

Imhauser's Watchman's Time Detectors

That cannot Fail.

Highest Award Pan-American Exposition

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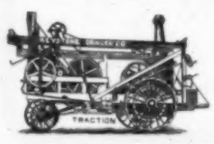

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If you want an automatic stoker that is entirely automatic.
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If you want to be able to burn a cheap coal instead of a high grade.
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Then you want the

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For the busy man, the Solid Belt Dressing is a great convenience. We do not recommend it quite so highly as our Paste Dressing, but it is possibly superior to anything of the kind in the market.

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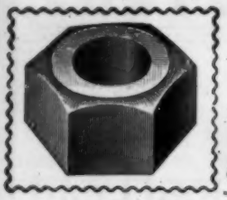

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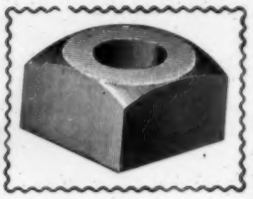

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(Annual Capacity about 150,000 Tons.)

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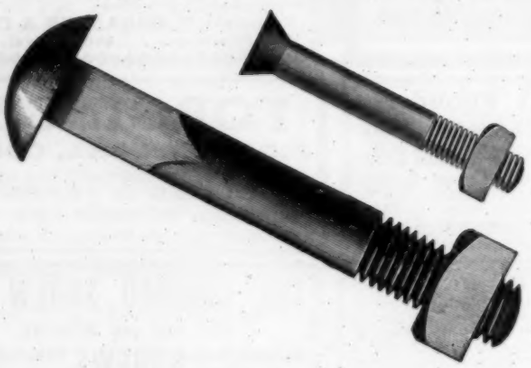

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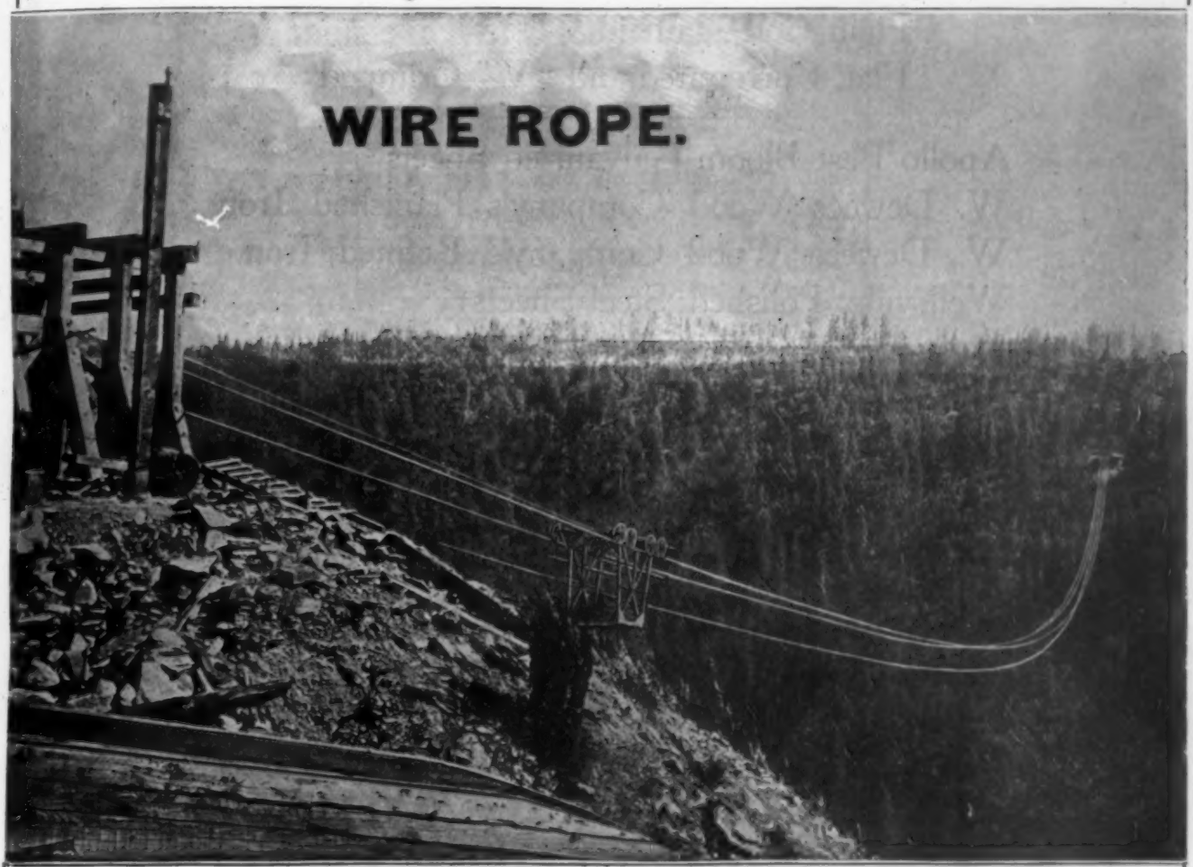

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Manufacturers of all varieties of

IRON AND STEEL SHEETS

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Foreign and Domestic Iron and Steel Products, Machinery, Etc.

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This (MF) trade mark is stamped on every sheet of the best roofing tin made. This (MF) mark means "Most Favored," because this brand is most favored by architects, dealers, and builders everywhere. MF Roofing Tin was first made in Wales 50 years ago—later the process was improved in America—and the product developed, until now MF Roofing Tin is more in demand than any other brand. The superior quality of MF Roofing Tin is attested by the first prize awarded it at the Paris Exposition, 1900, where it was in competition with all the world.

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The entire tinning process is effected by skilled hand labor, without the use of acids or rolls. The very best plates, the greatest amount of pure tin and new lead, the utmost care in manufacture, successively contribute to making MF the best of all roofing. It is most economical, because it lasts longest—many roofs made of MF 50 years ago are sound as ever today. MF Roofing Tin is sold by dealers everywhere. Specify it in your building estimates. Ask your roofer,

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If you want the latest and best machinery for this class of work, we build it. We brought out this line of machinery, have kept fully posted regarding any improvement which would make it better, and our present line of Winders, Cutters and Hammers represents the best practice of today.

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Annealed and Galvanized Fence Wire, and Hartman Wire Fencing.

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No troubles arising from use of fine ore—No flue dust waste, if Blast Furnace managers use the

WHITE BRIQUETTING PRESS.

Puts into solid block form fine ores and flue dust.

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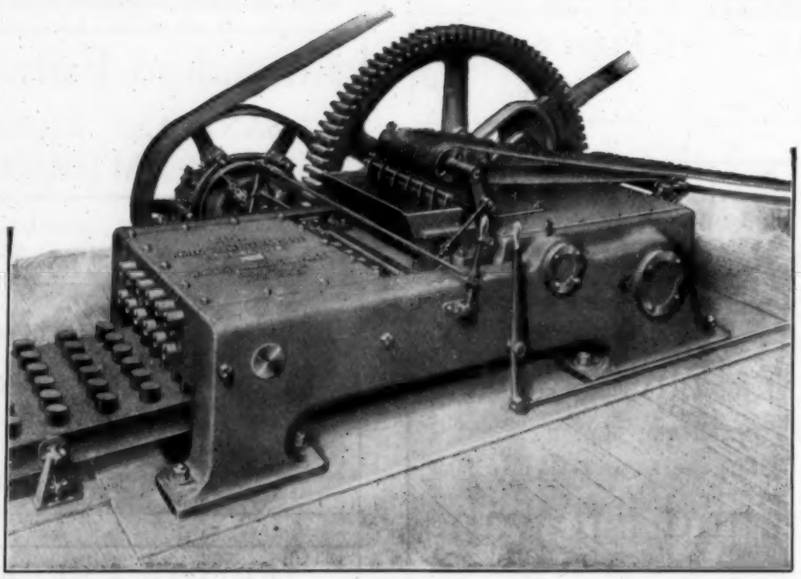

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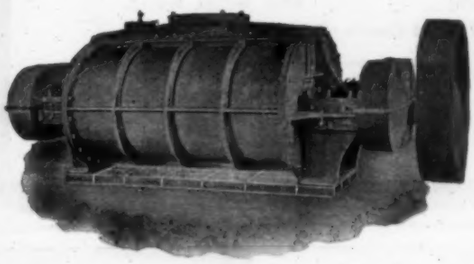
A prominent foundryman gives his opinion of the CYCLOIDAL BLOWER as follows:

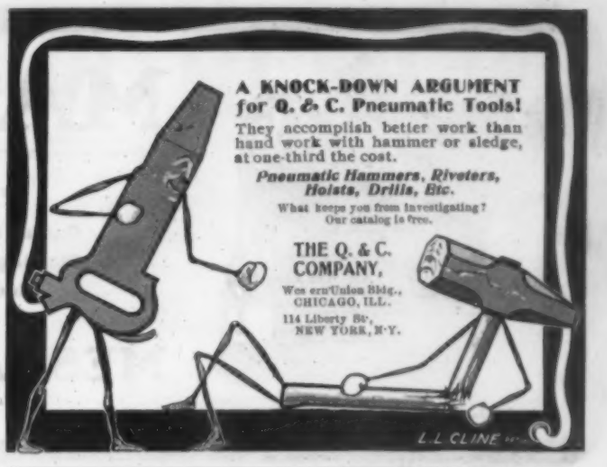


"There is absolutely no comparison between the CYCLOIDAL BLOWER and the Fan Blower. Since we installed a CYCLOIDAL we have been able to melt more iron in a great deal less time and with less power than formerly. We have saved considerable on coke and on 'labor for heat' by its use, to say nothing of other expenses and liability of breakage we experienced with the fan."

It will pay you to throw your old fan away and get a CYCLOIDAL BLOWER.

The Connersville Blower Co.,

Connersville, Indiana.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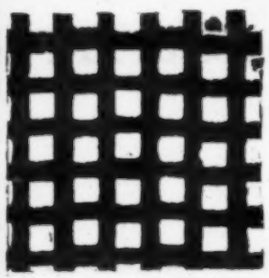

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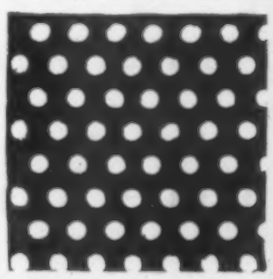

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—"a steel refiner and carbonizer, not a tempering compound."

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when great tensile strength is required the use of CARBO-MANGAN will show an average gain of 25 per cent. Evaporation slight, Compound good until used, making cost light; full instructions with each order. We guarantee all we claim.

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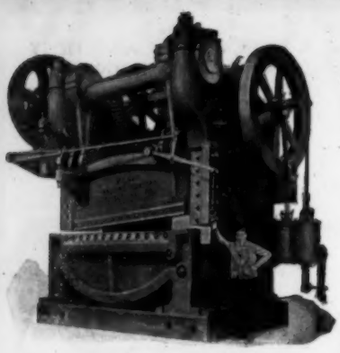

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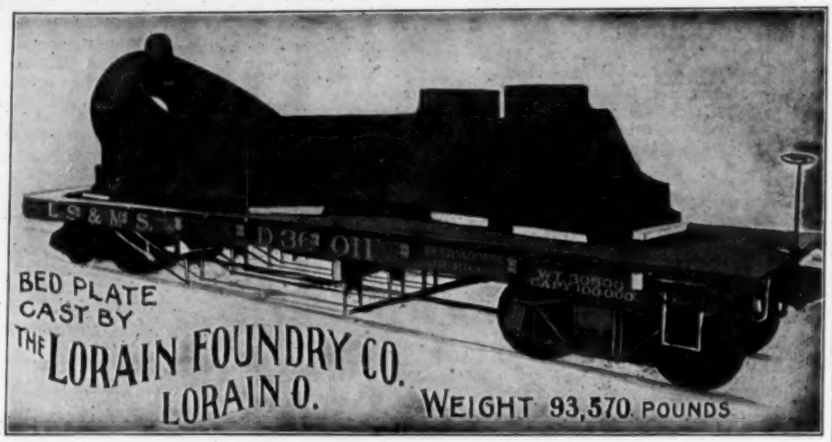

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